Nevada Department of Transportation

NEVADA DOT

Storm Water Quality Manuals

Planning and Design Guide

January 2006

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NDOT TRANSMITTAL

EFFECTIVE DATE: *January 3, 2006*

TO: **All Storm Water Quality Handbook *Planning and Design Guide* Manual holders**
FROM: **Water Quality, Erosion and Sediment Control (WQESC) Implementation Team**
RE: **Replacement sheets for Manual Revision**

Instructions:
Page numbers and corresponding sheet-counts are given in the table below to indicate portions of the *Planning and Design Guide* Manual that are to be removed and inserted to accomplish this revision.

Section	Remove		Insert	
	Pages	Sheets	Pages	Sheets
Forward - Revision Procedure		1		1
Table of Contents	i-iv	2	i-iv	2
Section 1 - Introduction	1-22 of 22	11	1-23	12
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Section 4 - Information for Selection and Design of Permanent BMPs	13 of 13	1	13	1
Section 5 - Information for the Construction Phase (Remove tab along with sheets)	1-9 of 9	5	none	none
Appendix A - Cover Sheet	1	1	1	1
Appendix A - Guideline for Project Categorization Score Sheet (was Environmental Score Sheet)	1	1	1-2	1
Appendix A - Project Categorization Score Sheet	1	1	1	1
Appendix A - NDEP Notice of Intent (NOI) Form	all	3	none	none
Appendix A - NDEP Notice of Termination (NOT) Form	all	3	none	none
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NEVADA DEPARTMENT OF TRANSPORTATION

STORM WATER QUALITY HANDBOOKS
PLANNING AND DESIGN GUIDE

PROCEDURE FOR MANUAL REVISIONS

This manual was developed to reflect current policies, procedures, and practices. It is intended that the manual be periodically revised. Two procedures are included. For edits or updates, contact Thresa Zylstra, NDOT Hydraulics Administrative Assistant, at 775-888-7619. All updates will be available on the NDOT website which should be visited regularly for updated information.

Temporary Revisions

As new policies, procedures, and directives are developed, it is sometimes necessary to provide this information to field personnel prior to a scheduled revision. To expedite distribution of revisions, the Water Quality, Erosion and Sediment Control (WQESC) Implementation Team will issue "Temporary Revisions" as needs arise. The "Temporary Revision" should be inserted in the manual prior to the page it modifies.

Scheduled Revisions

In October of each year, the Implementation Team will review the manual to determine if revisions are required. The Implementation Team is comprised of staff from design, construction, maintenance, environmental services, materials, and FHWA and NDEP if necessary.

Revisions affecting department policies and procedures proposed by the Implementation Team will be reviewed by a Steering Committee. Results of the Steering Committee Meeting will be provided to the Implementation Team. After revisions have been approved, the Implementation Team will initiate the changes and distribute them to all holders of the manual. Revisions will be transmitted under a cover memorandum. Each page of the revision will contain a revision date. It will be the manual holders' responsibility to insert the new material in the manual.

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Section 1
Introduction

1.1 Overview

This Project Planning and Design Guide (PDG) provides guidance for incorporating permanent storm water quality controls into new projects during the planning and design phases. The PDG addresses key regulatory, policy, and technical requirements to implement permanent storm water Best Management Practices (BMPs) into the design of all NDOT projects.

This manual describes the process for selecting and designing BMPs and incorporating them into the appropriate documents. Such documents include the Alternative Design Field Survey Report (ADFS), Preliminary Design Field Study Report (PDFS), the Environmental Documents, and the Plans, Specifications, and Estimates (PS&E).

The planning and design approach described herein has been developed for use in conjunction with NDOT's Roadway Design and Drainage Design Manuals. The PDG also provides guidance for incorporating requirements in the PS&E to ensure that the contractor complies with applicable permits and NDOT policy, and implements appropriate Construction Site BMPs.

1.1.1 Planning and Design Guide Organization

The PDG is organized as follows:

Section 1 – Introduction: Presents the goals and objectives of the manual, an overview of water quality in the planning and design process, summarizes relevant regulations and permits, the roles and responsibilities of NDOT staff and contractors for compliance. This section also presents the organization of this handbook.

Section 2 – Storm Water Quality Considerations During Project Planning: Provides project engineers and planners guidance on defining and avoiding potential project impacts, and reviews requirements of environmental studies and permits to determine if additional project-specific controls are required. This section also addresses the preliminary sizing of permanent treatment control devices.

Section 3 – Storm Water Quality Considerations During Project Design: Presents information on the delineation of drainage areas and disturbed areas associated with construction, considerations of the need for treatment controls, climatic and site-specific drainage area conditions, general design practices and design of permanent BMPs. This section also addresses the preparation of Standard Special Provisions or Pull Sheets, and outlines contractor responsibilities for the preparation of the SWPPP to be included in the bidding documents.

Section 4 – Guidance for Selection and Design of Permanent BMPs: Describes general design practices for permanent soil stabilization, streambank and open channel erosion controls, and permanent treatment control BMPs.

Section 5- Information needed for Construction Phase: Describes the information requirements that NDOT needs to supply to the contractor for the preparation of the Storm Water Pollution Prevention Plan and the planning and design staff's responsibilities for incorporating temporary BMP requirements in the PS&E.

Appendix A – Environmental categorization Score Sheet, TRPA/NDOT MOU, TRPA Initial Environmental Checklist, TRPA Permit Guidelines for Linear Public Service Projects, TRPA Guidelines for Exempt or Qualified Exempt Projects: This appendix contains copies of the Project Categorization Score Sheet and Instructions, copies of the TRPA's Initial Environmental Checklist and instructions for completion and other relevant TRPA permitting guidelines.

Appendix B – Working Details for Permanent BMPs: Contains Fact Sheets and details for approved permanent source and treatment control BMPs.

Appendix C – Design Examples for Permanent Treatment BMPs: A hypothetical design example is presented to illustrate the calculation of Water Quality Volume and Flow (WQV and WQF), Sand Storage Volume, Infiltration Basin Surface Area, and Sand Trap Settling Volume.

Appendix D – Relevant Storm Water documents and Web Sites: Two tables provide a summary of relevant storm water related documents and their purposes, and links to web sites that are mentioned in this document are provided here.

1.1.2 Goals and Objectives

NDOT is developing a coordinated statewide program to prevent pollution resulting from storm water runoff and wind erosion from NDOT facilities. The goal of this PDG is to provide direction to NDOT staff on regulatory compliance and permanent BMP selection, design, implementation, operation, and maintenance. The PDG will assist NDOT staff to integrate permanent environmental quality controls and requirements for construction site (temporary) BMPs into the NDOT planning and design process and the appropriate contract documents.

The PDG is one of two manuals that have been prepared as part of NDOT's Water Quality and Erosion and Sediment Control Program. The second, the Construction Site Best Management Practices Manual, provides direction for the use of temporary BMPs to prevent pollution from runoff and wind during construction activities and for the preparation of Storm Water Pollution Prevention Plans (SWPPPs). SWPPPs are required as part of the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit) for projects disturbing greater than 1 acre of soil. The overall objective of these manuals is to minimize short and long-term water quality impacts from water and air-borne sediment and other constituents of

concern and to provide NDOT with assistance in compliance with applicable regulatory requirements.

1.1.3 Storm Water Pollutants

Discharges from storm water drainage systems associated with highways and highway-related properties, facilities, and activities can contain a variety of pollutants that have the potential to adversely impact receiving waters. Of primary concern is the accelerated soil erosion and sedimentation that results from exposing or disturbing land areas by construction or maintenance activities or from the increased surface runoff that results from the creation of areas that are impervious to the infiltration of storm water such as newly paved surfaces. Other storm water pollutants can include biological nutrients, exhaust products, brake and tire materials, oil and grease, leaks and spills of fuels, oil, antifreeze, litter, and many other materials.

1.1.4 Project Development and Design Overview

The development of a new NDOT project typically consists of a project planning and scoping phase, followed by the preliminary and final design phases.

During initial project development and scoping, a reasonable number of alternatives are generally developed and reviewed. For NDOT projects this includes the Alternatives Design Field Study (ADFS). In this project phase, engineering studies are conducted to compare alignments and their associated impacts. Additionally, an effort is made to design the project to take advantage of the topography, soils, waterways, and natural vegetation at the site and minimize impacts on the existing environment. For any project involving a federal action or receiving federal funding, an environmental document is prepared in accordance with the National Environmental Policy Act (NEPA) (see Section 1.2.1.2).

Following the design alternative selection process, a Preliminary Design Field Study (PDFS) meeting is held, where the various NDOT divisions and other interested agencies meet to refine the project scope. Following the PDFS, recommendations for improvements are included in a PDFS Report, which identifies the major project design features. A public meeting may be held to solicit input/comments to the design features.

Following the approval of the PDFS Report, the Road Design Division, with input from other divisions, develops the 30%, 60%, 90%, 100% and final PS&E. Construction, Maintenance, Hydraulics, Environmental, Materials, Safety-Traffic, and other affected NDOT divisions normally perform a detailed review at the 60% and/or 100% design submittals.

NDOT's *"Project Design Development Manual"*(PDDM) illustrates the design process with a detailed flowchart that is hyperlinked to various sources for further explanations. NDOT design procedures are covered within this document as they pertain to water quality and other environmental issues only. For more detailed guidance on the design process, see the PDDM.

1.1.5 Permanent BMP Selection and Design Process

For the scope of this manual, permanent BMPs are those facilities and features designed into the project to control erosion and sedimentation and protect water and air quality after construction activities have been completed. Permanent BMPs are always part of the project design and are incorporated into the PS&E. Since they are treated similarly to other permanent design features, the procedures for detailing, specifying, and ensuring proper construction is familiar to NDOT designers and resident engineers.

During the design phase, specific permanent erosion, sediment, and water quality control features are incorporated into the project plans. Depending on the nature of the project and how extensive the need is for such controls, these design features may be included at any stage prior to 60% design. Incorporating permanent BMPs into the PS&E is performed primarily by the Hydraulics Section, with input and support of other sections.

The Road Design Division prepares the structure list and compiles the quantity estimates, and the items and quantities are shown on the plans as well as in the structure list. The project contributors also coordinate with the Specifications Section, which maintains the Standard Specifications, the Pull Sheets, the Standard Plans, CADD standards, and writes the contract special provisions. The PS&E package provides clear direction to both the contractor and the resident engineer as to how the project must be constructed.

1.2 Regulations and Permits

Regulations and permits are effective tools utilized by public agencies with regulatory powers for the protection of the environment. This section summarizes Federal, State, and Local regulations and permits applicable to NDOT construction, maintenance and operations activities.

1.2.1 Federal Regulations

1.2.1.1 Intermodal Surface Transportation Efficiency Act (ISTEA)

- Section 1057 of the Intermodal Surface Transportation Efficiency Act (ISTEA) requires the Federal Highway Administration (FHWA) to develop erosion and sediment control guidelines for states to follow on highway projects using federal funding (funded under title 23 United States Code).

- In a revision to 23 CFR 650, subpart B, FHWA has adopted the American Association of State Highway and Transportation Officials (AASHTO) highway drainage guidelines to comply with the ISTEA. The revision requires states to either apply these guidelines or to develop their own, more stringent, guidelines to develop standards and practices for the control of erosion.

In compliance with the above regulations, NDOT is developing and implementing the water quality control guidelines contained within these manuals.

1.2.1.2 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires that all federal agencies identify the environmental impacts of proposed activities, including impacts to water and air quality. This requires the agency to conduct a preliminary investigation of potential effects of their actions, and decide whether further investigation is warranted.

NDOT projects are subject to NEPA requirements when Federal funds or actions are involved. Some projects could be considered for categorical exclusion (CE) status if a federal agency determines that the project will not have a significant impact on the environment. NEPA provides for CE of certain activities such as emergency repair work and maintenance activities.

An Environmental Assessment (EA) is prepared for projects that are expected to have some impacts and a Finding of No Significant Impact (FONSI) is issued by the FHWA when minimal or no adverse impacts are identified. The EA also includes procedures to minimize and/or mitigate the identified impacts.

An Environmental Impact Statement (EIS) is prepared for complex projects expected to have a significant impact to the human and natural environment. A Record of Decision detailing project activities and mitigation commitments is issued by the FHWA. An EIS is a detailed document that describes project alternatives to minimize the identified impacts and is subjected to comments from interested outside parties.

1.2.1.3 Clean Water Act

The 1972 Federal Water Pollution Control Act (FWPCA) was amended in 1977 and subsequently referred to as the Clean Water Act (CWA). The 1987 Water Quality Act (WQA) also amends the 1972 FWPCA and forms the legislative basis for all federal storm water regulations. The 1987 amendments require NPDES permits for storm water discharges from municipal separate storm sewer systems (MS4s) and industrial activities including construction. In 1990, the U.S. Environmental Protection Agency (EPA) issued the final NPDES regulations governing storm water discharges. Storm water NPDES permitting was implemented in two phases.

Phase I permits were issued in 1990 and were required for:

- Facilities previously permitted for storm water discharges.
- Industrial activities, including construction sites disturbing 5 acres or more, and transportation facilities.
- Large (pop.>250,000) and Medium (100,000<pop.<250,000) Municipal Separate Storm Sewer Systems (MS4s). Drainage systems for roads and highways are generally considered MS4 systems.
- Facilities determined to be "significant contributors" of pollutants to waters of the United States (U.S.)

Phase II permitting became effective on March 10, 2003 and permit coverage is required for:

- Regulated small MS4s (Population greater than 50,000 and density of 1,000 people/sq. mi.).
- Industrial activities, including construction sites disturbing 1 acre or more and transportation facilities.

1.2.1.4 Clean Water Act, Section 404

Under Section 404 of the Clean Water Act, the United States Army Corps of Engineers (USACE) issues permits to allow discharges of dredged or fill material to waters of the United States, including oceans, lakes, streams, and wetlands. There are two basic types of 404 permits, an individual permit and a general permit. Section 404 permits can be categorized into two basic types as follows:

- **Individual Permits:** Individual permits are typically required for projects that have potentially significant impacts to the environment. There are two types of individual permits: Standard Permits and Letters of Permission. A Standard Permit is one that has been processed through the public interest procedures, including a public notice and receipt of comments. A Letter of Permission is issued through an abbreviated processing procedure, which includes a public interest evaluation, but no individual public notice.
- **General Permits:** General permits are divided into two categories: Regional Permits and Nationwide Permits. Regional Permits are issued by the USACE District or Division Engineers on a regional basis. Nationwide Permits are issued by the USACE Chief of Engineers through publication in the Federal Register and are applicable throughout the nation. Regional Permits and Nationwide Permits cover discharges that are similar in nature, and will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effect on the environment, as determined by the USACE.

Application Procedures:

The USACE District Engineer or regulatory staff is available for pre-application consultation. Upon receipt of the permit application, the USACE District Engineer will notify affected agencies (federal, state, or local) and the public. If preparation of an environmental document is required, the District Engineer will contact the applicant and advise them of the requirements. The application form includes a complete description of the proposed activity including necessary drawings, sketches, or plans sufficient for public notice. Applications are determined to be complete when sufficient information has been submitted to issue a public notice, and the appropriate fee has been received. There is no fee if the permit is withdrawn prior to the issuance of the permit or if the permit is denied.

If an application has been approved, the permittee is required to show that they are avoiding wetland impacts where practicable, minimizing potential impacts to

wetlands, and providing mitigation for unavoidable impacts, to comply with the Corps' 'no net loss' standards for wetlands. (For more information on obtaining a 404 permit see Code of Federal Regulations Title 33 Parts 320-331 and Section 404 of the Clean Water Act). NDOT Standard Specifications Section 108 contains contractor requirements for permit compliance.

The 404 Permit includes any special conditions included in the local 401 certification (See Section 1.2.1.5), and if threatened or endangered species may be affected, the US Fish and Wildlife Service will be consulted, as well as Nevada Department of Wildlife (NDOW), and the Nevada Division of Forestry (NDF). An effort is made to align the 404 Permit requirements with other regulatory requirements through early coordination with the involved agencies.

1.2.1.5 Water Quality Certification (CWA Section 401)

Projects requiring a Section 404 Permit (See Section 1.2.1.4) must also obtain State certification that the proposed activity will not contribute to or cause violations of, State and Federal water quality standards. The CWA addresses the following:

- Beneficial Uses of Water – benefits to aquatic life, agriculture, recreation, water supply, industrial supply, and propagation of wildlife must be protected;
- Water quality standards – numeric and narrative limits or bans on substances or processes that alter concentrations of dissolved oxygen, temperature, and turbidity; and
- Anti-degradation – requires that surface waters whose quality is higher than the applicable standards must be protected.

NDOT's Environmental Section typically obtains coverage under this permit, and NDEP is the agency responsible for certification. The 401 certification often includes special conditions in order to remove or mitigate potential impacts to water quality standards. These may include but are not limited to seasonal limits on when work can be performed, incorporation of water pollution controls (BMPs), and treatment of sediment impacted water prior to release. Water quality monitoring upstream and downstream of the work may also be a requirement to ascertain whether the project is impacting the receiving water.

1.2.2 Nevada Regulations

The State of Nevada has adopted narrative and numeric water quality standards to protect the designated beneficial uses for water bodies in the state. The narrative standards are applicable to all surface waters of the state and consist of statements requiring waters to be free from various pollutants including those that are toxic. The numeric standards are assigned by class. Classes of water are listed from A to D, with A being the highest quality.

Additionally, site-specific numeric standards for certain constituents have been developed for major water bodies (e.g. Lake Tahoe, Lake Mead). Water quality

standards for surface waters in the state of Nevada are published in the Nevada Administrative Code (NAC), Chapter 445A.119-445A.225.

Total maximum daily loads (TMDLs) are an assessment of the amount of pollutant a water body can receive and not violate water quality standards. Nevada is required by section 303(d) of the CWA to identify and prioritize waters that are impaired for one or more pollutants. Following identification of impaired waters, TMDLs are goals developed for the pollutant, with the scheduling of TMDLs, based on the prioritization. Adoption of the TMDL results in an implementation plan, generally enforced through permits, to achieve the targeted reduction in pollutants in the TMDL. TMDLs are currently implemented through NPDES permits for point source discharges and voluntary non-point source control programsUnder the current TMDL program, numeric standards for storm water runoff have not been developed in Nevada because storm water runoff from highways and highway facilities is highly variable. To address highway runoff, the NPDES program has emphasized implementation of BMPs and monitoring. Current and tentative TMDL information can be obtained from the Nevada Division of Environmental Protection (NDEP).

1.2.2.1 General Permit for Storm Water Discharges Associated with Construction Activity

1.2.2.1.1 Permit Background

NDEP updated the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit) in September 2002 to include Phase II of NPDES storm water permitting as discussed in Section 1.2.1.3. Construction projects that disturb one acre or more of land require coverage under this permit.

Disturbance is defined as clearing, grading, or excavating underlying and/or surrounding soil as part of the repaving operation. NDEP may also require general permit coverage if repaving operations create loose fine-grained material (e.g. asphalt millings) that is not immediately disposed of and/or is stockpiled on the site. If the material is immediately overlaid or hauled off-site, a permit may not be required depending on site-specific conditions. The use of asphalt millings as a permanent soil stabilization method by immediately spreading and compacting is approved by NDEP and NDOT (see permanent BMP fact sheet for hard surfaces in Appendix B). Contact NDEP's Storm Water Coordinator prior to the start of construction if general permit coverage is questionable for a particular project.

Temporary concrete, asphalt, and material plants or operations also require permit coverage. If the plant or operation is dedicated to a permitted construction project, the permit covers storm water discharge. However, a separate SWPPP must be prepared to address storm water controls specific to the plant or operations.

Construction activity that results in soil disturbances of less than one acre is subject to this General Permit if the construction activity is part of a larger common plan of development or sale totaling one acre or more of soil disturbing activities, or if there is the potential for significant water quality impairment resulting from the activity as determined by the NDEP.

1.2.2.1.2 NDOT Policy for General Permit Compliance

For all NDOT projects disturbing one acre of more, the contactor is required to obtain coverage under the General Permit by submitting a Notice of Intent (NOI) and the appropriate filing fee with the NDEP two (2) days prior to the start of construction. In addition, a SWPPP must be completed by the contractor and be available for review at the project site prior to filing the NOI. The SWPPP is not submitted to NDEP for review and approval but must be present at the construction site and presented to NDEP inspectors upon request. The contractor is fully responsible for the SWPPP development, implementation and update, and any fines imposed. NDOT requires the contractor to employ a Professional Engineer (PE) to prepare the SWPPP for all high potential impact projects (see Section 3.7) and for BMP design as specified in the Construction Site BMP Manual.

The contractor is responsible for construction of the final stabilization measures needed for the construction site to meet NPDES General Permit requirements including seeding for re-vegetation or other appropriate stabilization as specified in the contract. The contractor is responsible for identifying pre-construction and post-construction vegetation coverage for the project and must submit this information to the RE. The information will be forwarded to District Maintenance after the contract is closed out.

Upon District acceptance of the contract (contractor completion), the contractor will submit the Notice of Termination (NOT) to the NDEP. This ends the contractor's responsibilities with respect to permit compliance. If final stabilization has not yet been achieved per NDEP requirements, permit coverage is transferred to NDOT until 70% re-vegetation is established. This requires written notification to NDEP from NDOT at the time the contractor submits the NOT to formally transfer control of the General Permit designating NDOT as the permittee.

The project is then turned over to District Maintenance who, under the Environmental Division's direction, will be responsible for additional seeding or irrigation or performing other necessary activities to fulfill the 70% re-vegetation requirement to achieve site stabilization. During this time, all of the requirements of the General Permit still apply to the project including inspecting and maintaining the appropriate temporary BMPs. After final site stabilization has been completed, District Maintenance will remove the temporary BMPs and file the NOT, which will release NDOT from General Permit coverage. An outside contractor may also be hired to perform the final stabilization work.

In some cases, the NDEP may view two (2) or more small projects (less than 1 acre of soil disturbance) in the same corridor as part of a larger common plan of development and therefore require General Permit coverage. If multiple contractors are used, special arrangements may be required to determine responsibilities for SWPPP preparation and General Permit compliance. Additional guidance to contractors on permit compliance and SWPPP preparation is presented in the Construction Site BMP Manual.

1.2.2.2 Other NDOT NPDES Permits

As discussed in Section 1.2.1.3, NDOT is subject to NPDES permits authorizing storm water discharges from industrial activities including construction (Section 1.2.2.1) and from MS4s. This section addresses the following two NPDES permits that are in addition to the General Permit discussed above:

- National Pollutant Discharge Elimination System Permit for Discharges from Nevada Department of Transportation Municipal Separate Storm Sewer Systems (NV0023329) or (Statewide MS4 Permit), and

- Stateline Stormwater Association and Members, Authorization to Discharge (NV0023051) or (Stateline Permit).

Both of these permits require extensive Departmental and interagency coordination to achieve compliance through integrated planning. Both permits are managed by the Environmental Services Division's Water Quality Specialist (WQS).

1.2.2.2.1 Statewide MS4 Permit

NDOT is currently regulated by a statewide National Pollutant Discharge Elimination System for Discharges from Nevada Department of Transportation Municipal Separate Storm Sewer Systems (NPDES Permit No. NV0023329) authorizing discharges from NDOT MS4s. This permit authorizes NDOT to discharge storm water and certain non-storm water runoff to waters of the United States. The permit includes conditions that are intended to protect the quality of the receiving waters. These conditions include:

- Special considerations and actions for discharges to impaired water bodies included on the State of Nevada 303(d) list;

- Development, implementation, and enforcement of a Statewide Storm Water Management Program (SWMP). Program elements include:

  - Public Outreach and Education,

  - Intergovernmental Coordination,

  - Best Management Practices,

  - Illicit Discharge Detection and Elimination,

  - Construction Site BMP Program,

  - Maintenance Program Management (including the development and implementation of Maintenance Facility Pollution Prevention Plans),

  - Reviewing and updating the SWMP through monitoring, record keeping and reporting evaluations of obligate measurable goals outlined in the SWMP,

- Development, implementation, and enforcement of a separate, specific SWMP for Clear Creek.

Coverage under this permit must be maintained by submission of applications and fees per the schedule specified in the existing permit. Important information required in the applications includes information regarding receiving waters and their 303(d) status and information on BMPs, their goals and identification of the person(s) responsible for the SWMP.

1.2.2.2.2 Stateline Permit

NDOT is also regulated by a specific NPDES Permit that authorizes storm water discharges from U.S. Highway 50 to a central storm water treatment unit, which in turn flows to the Edgewood Creek watershed in South Lake Tahoe. NDOT is a co-permittee with several private entities and Douglas County (collectively the Stateline Storm Water Association), who share operation and maintenance responsibilities for the common facilities of the storm water treatment system.

This permit uses numerical water quality criteria developed by the TRPA for surface and groundwater discharges. For reasons that are described in the permit, the groundwater discharge criteria are applied as limits, and surface water discharge criteria are applied as goals, with the requirement to attempt improvements should exceedances persist.

The permit requires implementation of a Monitoring Plan, an Operation and Maintenance Plan and submission of annual reports that include plans to improve the system performance if exceedances persist or if reasonable improvements can be made. At the present time (2004), a consultant retained by the Stateline Stormwater Association is implementing the monitoring plan and managing the operation and maintenance requirements including reporting. The Environmental Services Division coordinates with District II to manage this permit.

1.2.2.3 Temporary Work in Waterways/Discharge Permit (Formerly Rolling Stock Permit)

A Temporary Working in Waterways/Discharge Permit is required by NDEP for work within or immediately adjacent to, live streams or water bodies. Permits are issued for both routine maintenance (culvert cleaning, clearing and snagging, etc.) and for short-term construction projects. NDEP issues individual temporary permits valid for no longer than six months. The Environmental Services Division is working with the Districts to obtain General Permits for Routine Maintenance Activities Working in Waters of the State. They are valid for (5) years and can be renewed. NDEP issued Maintenance General Permit No. GNV9800002 to District III on April 5, 2004. NDEP reviews and approves the submitted Temporary Working in Waterways/Discharge Permit application before work can start. For projects that require General Permit coverage in addition to this permit, the SWPPP may be submitted to the NDEP as part of the Temporary Working in Waterways/Discharge Permit application. For NDOT projects the contractor is responsible for obtaining this

permit, where applicable, and the NDOT Water Quality Specialist provides oversight of the process if necessary.

The Temporary Working in Waterways/Discharge Permit application must include a detailed description of the BMPs to be implemented during the disturbance and/or work activities proposed in and along the stated water body for: water quality protection; erosion control; sediment control; riparian stream zone protection and restoration; streambank stabilization/protection/rehabilitation, water pollution control/prevention, dewatering controls, etc. Water quality monitoring may also be a permit requirement to verify compliance with the applicable receiving water standards.

An effort is made to align the permit requirements with any required 404 Permit and 401 Certification (see below). For projects that require these permits and coverage under the General Permit, the SWPPP may be submitted to the NDEP as part of the Rolling Stock Permit BMP description requirements.

1.2.3 Lake Tahoe Regulations and Permitting

1.2.3.1 Background

Congress created the Tahoe Regional Planning Agency (TRPA) in 1969 with the enactment of the Tahoe Regional Planning Compact (Compact). The bi-state agency's mission, as outlined in the Compact, includes the establishment of Environmental Threshold Carrying Capacities, and a Regional Plan and Code of Ordinances "which will achieve and maintain such capacities while providing opportunities for orderly growth and development consistent with such capacities".

The environmental thresholds have been developed in the following nine areas:

- Water Quality
- Air Quality
- Soil Conservation
- Vegetation
- Fish Habitat
- Wildlife Habitat
- Noise
- Scenic resources and
- Recreation

As outlined in the Regional Plan, the TRPA has also developed an Environmental Improvement Program (EIP) that identifies programs, projects, and studies that are intended to attain, maintain, or surpass the environmental thresholds. NDOT is

participating in the EIP through the development and implementation of the NDOT Tahoe Master Plan.

As a regulatory agency, the TRPA reviews and permits construction projects, and seeks to minimize environmental impacts of new projects. Permits issued include Standard Conditions of Approval and Special Conditions for individual projects. Permanent and temporary erosion control devices are required for applicable projects.

In September of 1990 NDOT and the TRPA entered into a Memorandum of Understanding (MOU) that lists certain activities, such as routine maintenance, as not requiring TRPA review and approval, provided that they do not result in the creation of additional land coverage or relocation of land coverage. A copy of the MOU is provided in Appendix A.

There are numerous differences between typical TRPA construction permit conditions and those in the Nevada General Construction Permit. The TRPA permits are issued individually and are generally more stringent and include the following major differences:

- An expanded definition of stream environment zones (SEZs),
- With limited exceptions, no ground disturbances are allowed between October 15 and May 1,
- Projects are required, where feasible, to incorporate permanent facilities capable of retaining and treating the volume of a 1-hour, 20-year storm event (approximately 1-inch of rain in a one hour period).
- Completion of the Initial Environmental Checklist (IEC) for projects not covered under the NDOT/TRPA MOU or Qualified Exempt activities is required. Large projects may require an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). These documents are similar to, yet separate from the NEPA environmental documents, however, they may be combined into a joint document to satisfy both NEPA and TRPA requirements if appropriate. A copy of the IEC is provided in Appendix A.
- A verification of the land capability and existing impervious coverage may also be required within the project's limits.

1.2.3.2 Permitting Policy and Procedures

All projects in the Lake Tahoe Basin are considered to be high potential impact projects per the Project Categorization Score Sheet (for additional information regarding the Score Sheet see section 3.6.1). The following procedure applies to in-house design and consultant projects in the Lake Tahoe Basin. For typical maintenance activities within the Tahoe Basin, see Section 1.3.7.3.

For applicable projects not covered under the NDOT/TRPA MOU or qualified exempt activities, the following procedure applies. The project coordinator/manager or engineering consultant, with input from Environmental staff and the Lake Tahoe EIP coordinator, will complete the TRPA IEC and compile supporting documentation required for permit submittal. The checklist will be submitted along with required documentation to the Tahoe EIP coordinator for initial review. Upon the initial review, concurrence on the IEC will be sought from the Chief Environmental Engineer. The Tahoe EIP coordinator will prepare and submit the application to TRPA. A complete application must be submitted at or prior to the 60% design level. Allow three months for final TRPA approval and acquisition of this permit from the time application is initially submitted. The Hydraulics Section will develop temporary soil and sediment control items and plans for inclusion in the final PS&E.

Prior to 90% design, the Lake Tahoe EIP coordinator will submit TRPA's permit requirements to the following division chiefs for their review: Environmental, Hydraulics, Roadway Design, Construction-Materials, Maintenance and Right-of-way. Upon approval by the division chiefs, the Chief Hydraulic Engineer will sign the TRPA permit. The Lake Tahoe EIP coordinator will include all applicable permit requirements in the final PS&E package.

A copy of TRPA Guidelines for obtaining a construction permit or for determining whether an activity is Exempt or Qualified Exempt from such permitting is included in Appendix A.

The Contractor:

- Complies with all conditions of the construction permit.
- The contractor's engineer attends the pre-grade meeting with TRPA and their contract compliance officer to identify all other BMP items required by TRPA.
- Includes any additional BMP requirements in the contractor's SWPPP prior to submittal to NDEP.

1.2.4 Irrigation Districts

Irrigation Districts may also have pollution control requirements for work performed within their boundaries. For example, the Truckee-Carson Irrigation District requires a construction license for projects that include road crossings over irrigation ditches or drainage ways. The licenses typically include requirements for bank stabilization and pollution prevention to the irrigation water. As part of the project planning process, local irrigation district offices should be contacted to determine the specific water pollution control requirements.

1.2.5 Air Quality Permits

1.2.5.1 Background

NDOT projects may also require coverage under various Air Quality or Dust Control Permits. NDOT contractors are responsible for obtaining these permits from the appropriate agency.

In Nevada, air quality is regulated by the NDEP or, within Washoe and Clark Counties, by each county's Air Quality Management Divisions. Permit requirements for the different jurisdictions are discussed below.

Air quality permits will also typically require some type of permanent soil stabilization after construction is complete. This stabilization may or may not be sufficient to satisfy the final stabilization requirements of the General Permit. The following methods shall be used to satisfy the final soil stabilization requirement of air quality permits for NDOT Projects:

- In northern areas of Nevada, where re-vegetation is feasible, seeding, slope paving, and application of millings to the shoulders will be the methods of stabilization.

- In southern urban areas, where re-vegetation is not successful, slope paving or rock mulch will be the methods of stabilization for cut and fill slopes. For aesthetic reasons, in an area contained within the landscape master plan, millings are not appropriate.

- In southern rural areas, soil stabilizers, slope paving, or application of millings will be the methods of soil stabilization.

Northern areas may be approximately defined as NDOT Districts 2 and 3, while southern areas consist mainly of District 1. The Project Manager/Coordinator should contact the Hydraulics section to determine the appropriate stabilization method. When seeding or rock mulch is required, Hydraulics will contact the NDOT Landscape Architect to develop a seed mix, application specification, or rock mulch color scheme.

1.2.5.2 NDEP

NDEP requires a Surface Area Disturbance Permit if land disturbance equals or exceeds five (5) acres. If the disturbed soil area exceeds twenty (20) acres, a dust control plan must also be submitted.

1.2.5.3 Clark County Department of Air Quality Management

In Clark County, the following construction activities require a Dust Control Permit:

- Soil disturbing or construction activity greater than or equal to one-quarter acre,

- Mechanized trenching greater than or equal to 100 feet in length, or

- Mechanical demolition of any structure larger than or equal to 1,000 ft^2.

In Clark County, a Dust Mitigation Plan is required for all projects and a Site Specific Dust Mitigation Plan is required for sites greater than 10 acres. Construction site superintendent(s), foremen and other designated on-site representatives, as well as the water truck/pull drivers are required to complete the Clark County Dust Control Class.

A Dust Control Monitor is required for all construction sites having 50 acres or more of actively disturbed soil at any given time. The Dust Control Monitor must also complete the required Clark County Dust Control Classes. The Monitor shall be present at all times during construction activities, and is required to do visual inspections, record keeping, deployment of resources, and shutdown or modification of construction activities as needed. Wind conditions can cause construction activity to cease if dust emissions are in excess of 20% opacity using the Time Averaged Method, in excess of 50% opacity using the Instantaneous Method, or are 100 yards or more in length from the point of origin. Refer to the Clark County Air Quality Regulations for additional guidance on dust control regulations.

Clark County Dust Control Permits require explicit payment for temporary and permanent dust control in contract estimates. To comply with this requirement, NDOT includes a lump sum bid item for these controls on all projects. This item is estimated as $1,000.00 plus 0.1% of the total project construction cost.

1.2.5.4 Washoe County District Health Department Air Quality Management Division

In Washoe County, a Dust Control Plan is required for projects disturbing more than one acre of soil. The Dust Control Plan must be present at all times at the construction site.

It is the responsibility of the contractor to be in compliance with the dust control regulations at all times. The contractor must agree to implement an acceptable method to prevent particulate matter from becoming airborne, such as the use of water trucks, windscreens, and speed limits. Additional precautions as reasonably prescribed by the Air Quality Management Division must be performed.

The site is subject to the right of inspection by an Air Pollution Investigator at any time. Acceptable control of airborne particulates must be in place or the construction activities can be suspended by the Air Pollution Inspector. Effective dust control must be in place 7 days a week, 24 hours a day from commencement of the project to final completion. Additional information regarding the Washoe County air quality requirements can be found in the Washoe County Dust Control Plan.

1.3 Permitting Roles and Responsibilities

Implementation of an NDOT water quality program requires teamwork and cooperation between all NDOT divisions, especially Environmental, Hydraulics,

Construction, Roadway Design, Specifications and District Maintenance staff. This section defines general divisional roles and responsibilities regarding BMP implementation and regulatory compliance.

1.3.1 Environmental Division

1.3.1.1 Permits

The Environmental Division is responsible for securing and/or providing oversight of all regulatory permits relative to water quality with the exception of the TRPA Construction Permit and Dust Control Permits. The Environmental Services' WQS is the primary contact for regulatory permit compliance particularly with the SWMP and construction issues associated with the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit). With aid from the Hydraulics Section, the Environmental Division oversees development of Storm Water Pollution Prevention Plans (SWPPPs) and Temporary Working in Waterway/ Discharge Permit BMP Plans for NDOT maintenance projects. Environmental and Hydraulics staff will work together as a team to identify and consult other Divisions to resolve all potential regulatory, construction, and maintenance issues.

1.3.1.2 BMPs and Specifications

The Environmental Division incorporates specific regulations and procedures into NDOT's Standard Specifications and project Special Provisions. Environmental Services often works with Hydraulics to identify and resolve potential regulatory, construction, and maintenance issues. This includes updating the Storm Water Quality Manuals and the Standards. All non-structural temporary BMPs and their associated specifications are also incorporated into the contract documents by the Environmental Division working with the Specifications Section. Responsibility is shared with Hydraulics for some structural BMPs, as shown in Table 1-1.

1.3.1.3 Monitoring

Environmental and Hydraulics staff will work together to perform necessary environmental monitoring associated with projects.

1.3.1.4 Construction Support

The Environmental Division's Water Quality Specialist is the primary contact for all unanticipated construction issues associated with General Permit or other regulatory requirements, and compliance. The Hydraulics Section will be contacted for support.

1.3.1.5 Maintenance Support

The WQS is the primary contact for water pollution control issues relative to maintenance practicesand oversees, with the aid of the Hydraulics Section, development of Storm Water Pollution Prevention Plans (SWPPPs) and Temporary Working in Waterway/Discharge Permit BMP Plans for NDOT maintenance projects.

1.3.1.6 Standards and Manuals

Environmental and Hydraulics staff work together to develop and maintain the BMP manuals, guidelines, and standards.

1.3.2 Hydraulics Section

The Hydraulics Section is responsible for determining water flows, drainage structure sizes, impacts to floodways and flood plains, slope renovation, road surface water treatment methods, and temporary and permanent erosion control.

1.3.2.1 Erosion Control Plans

For projects categorized as having a high potential for environmental impacts (see section 3.6.1), Hydraulics is responsible for development of a comprehensive erosion control and water quality plan to encompass all aspects of a project. When necessary, Hydraulics staff may consider phasing construction of permanent BMPs to accommodate implementation of temporary ones.

1.3.2.2 Permits

The Lake Tahoe EIP Coordinator will be responsible for securing TRPA construction permit.

Senior Hydraulic Engineers will provide technical support to Environmental staff to identify or resolve potential regulatory, construction, and maintenance issues.

1.3.2.3 BMPs and Specifications

Hydraulics is responsible for all permanent BMPs and all structural temporary BMPs and associated specifications. Responsibility is shared with the Environmental Division for some procedural and structural temporary BMPs (see Table 1-1).

1.3.2.4 Monitoring

Environmental and Hydraulics staff will work together to perform necessary environmental monitoring associated with projects. Hydraulics will be responsible for the coordination of all environmental monitoring in the Lake Tahoe Basin.

1.3.2.5 Research

Hydraulics is responsible for all research associated with structural BMP effectiveness and performance.

1.3.2.6 Standards and Manuals

Environmental and Hydraulics staff work together to develop and maintain the BMP manuals, guidelines and standards. See Section 1.4 for more details.

1.3.2.7 Design

The Hydraulics section is responsible for design of structural BMPs included in the project PS&E.

Table 1-1 on the following pages defines specific BMP management responsibilities of the Hydraulics Section and Environmental Division. The table outlines responsibility for a BMP when its modification, implementation, or deletion is questioned.

Table 1-1

Hydraulics and Environmental Temporary BMP Management Chart

Section 3 – Temporary Soil Stabilization BMPs		**Hydraulics**	**Environmental**
SS-1	Scheduling	X	X
SS-2	Preservation of Existing Vegetation	X	X
SS-3	Hydraulic Mulch	X	X
SS-4	Hydroseeding	X	X
SS-5	Soil Binders	X	
SS-6	Straw Mulch	X	X
SS-7	Geotextiles, Plastic Covers & Erosion Control Blankets / Mats	X	X
SS-8	Wood Mulching	X	X
SS-9	Earth Dikes / Drainage Swales & Lined Ditches	X	
SS-10	Outlet Protection / Velocity Dissipation Devices	X	
SS-11	Slope Drains	X	
SS-12	Streambank Stabilization		X
SS-13	Wind Erosion Control	X	X
Section 4 – Temporary Sediment Control BMPs		**Hydraulics**	**Environmental**
SC-1	Silt Fence	X	X
SC-2	Sediment Basin	X	
SC-3	Sediment Trap	X	
SC-4	Check Dam	X	
SC-5	Sediment Logs	X	X
SC-6	Gravel Bag Berm	X	X
SC-7	Street Sweeping and Vacuuming		X
SC-8	Storm Drain Inlet Protection	X	X
Section 5 – Tracking Control BMPs		**Hydraulics**	**Environmental**
TC-1	Stabilized Construction Entrance / Exit		X
TC-2	Stabilized Construction Roadway		X
TC-3	Entrance / Outlet Tire Wash		X
Section 6 – Non-Storm Water Management BMPs		**Hydraulics**	**Environmental**
NS-1	Water Conservation Practices		X
NS-2	Dewatering Operations	X	X

Table 1-1

Hydraulics and Environmental Temporary BMP Management Chart

NS-3	Paving and Grinding Operations		X
NS-4	Temporary Stream Crossing	X	X
NS-5	Clear Water Diversion	X	X
NS-6	Illicit Connection / Illegal Discharge Detection and Reporting		X
NS-7	Potable Water / Irrigation		X
NS-8	Vehicle and Equipment Cleaning		X
NS-9	Vehicle and Equipment Fueling		X
NS-10	Vehicle and Equipment Maintenance		X
NS-11	Pile Driving and Drilling Operations		X
NS-12	Concrete Curing		X
NS-13	Concrete Finishing		X
NS-14	Material and Equipment Use Over Water		X
NS-15	Structure Demolition / Removal		X
NS-16	Temporary Batch Plants		X
Section 7 –Waste Management & Materials Pollution Control BMPs		**Hydraulics**	**Environmental**
WM-1	Material Delivery and Storage		X
WM-2	Material Use		X
WM-3	Stockpile Management		X
WM-4	Spill Prevention and Control		X
WM-5	Construction Debris and Litter Management		X
WM-8	Concrete Waste Management		X
WM-9	Sanitary / Septic Waste Management		X
WM-10	Liquid Waste Management		X

1.3.3 Construction Division

The Construction Division performs construction for projects where no contractor is used and provides contractor oversight on contracted projects. This Division also performs constructability reviews during project development and design to address issues such as project phasing and contractor staging logistics.

1.3.3.1 SWPPP

The Construction Division is responsible for obtaining a copy of the SWPPP from the contractor or District for inclusion in the project files, as well as the following:

1.3.3.2 BMPs and Specifications

Construction is responsible for implementation and enforcement of BMPs specified for Lake Tahoe projects or on large projects where line items are included.

1.3.3.3 Implementation

Construction is responsible for monitoring BMP implementation on lump sum projects for purposes of payment.

1.3.4 Roadway Design Division

The Roadway Design sections have the overall responsibility for the preparation of highway construction plans and specifications in-house or through consultants.

1.3.4.1 Project Categorization

The Roadway Design Division is responsible for categorizing projects into No, Low, Medium, or High potential environmental impacts by completing the Project Categorization Score Sheet (Appendix A). The procedures for completing the Score Sheet are discussed in Sections 2, 3, and 5 of this manual. The Project Manager/Coordinator may consult with Environmental or Hydraulics as appropriate to accurately categorize the project.

Roadway Design also calculates and includes costs and necessary bid items in the PS&E document for all no, low, and medium impact projects.

1.3.4.2 BMPs and Specifications

The Landscape Architect will be responsible for development of seed specifications (seed mix, soil amendments, etc.)

1.3.5 Specifications Division

The Specifications Division generates and reviews general specifications to be included or updated in these NDOT Water Quality Handbooks.

1.3.6 Districts

1.3.6.1 General Permit Termination

If a construction project has not been stabilized upon contractor release, General Permit responsibility is relinquished to District Maintenance. District staff is responsible for filing the NOT after final site stabilization has been achieved.

1.3.6.2 Maintenance

District staff is responsible for establishing and maintaining re-vegetation after the contractor has been released. Additionally, the SWPPP, including temporary BMPs, must be inspected and maintained until coverage under the General Permit is terminated.

1.3.6.3 Monitoring

Monitoring post-project vegetation success is the responsibility of district staff. Environmental is available for assistance if needed.

1.3.7 Maintenance Projects

1.3.7.1 General Permit Compliance

For maintenance projects Hydraulics, Environmental, and District staff will work together to comply with the necessary regulatory requirements. Districts will be responsible for filing of the NOI, payment of the filing fee, preparation and updates of the Storm Water Pollution Prevention Plan (SWPPP), implementation of temporary BMPs, inspection and maintenance, final site stabilization, and filing of the NOT.

Hydraulics and Environmental staff will provide technical support as necessary to District Maintenance for development & implementation of SWPPP.

The primary contact for SWPPP development is the Environmental Division's Water Quality Specialist.

1.3.7.2 Clark County PM-10 Attainment

For maintenance projects where no contractor is involved, District I will be responsible for applying and obtaining the Clark County PM-10 Air Quality permit.

1.3.7.3 Lake Tahoe

For maintenance projects in the Lake Tahoe Basin, Hydraulics will obtain TRPA's construction permit for District II. Environmental will be responsible for all other permits except Dust Control.

1.3.7.4 Work in Waterways

Until General Permits are secured for each District, , District Maintenance is responsible for obtaining the Temporary Work in Waterways/Discharge Permit (formerly the Rolling Stock Permit) for maintenance projects in or near WOUS. Environmental is available for assistance if needed.

1.4 Water Quality, Erosion, and Sediment Control (WQESC) Program Responsibilities

NDOT has created a WQESC Implementation Team and a Steering Committee to develop and implement the WQESC program. It is important to coordinate activities, ensure identified processes are implemented, progress measures are developed and used, and corrective actions are made in a timely manner. This section describes the responsibilities and authority for ensuring that the goals and objectives of the program are developed with input from all users, and implemented throughout NDOT.

1.4.1 WQESC Implementation Team Responsibilities

The Implementation Team is tasked with ensuring elements of the program are reviewed and implemented, including specific actions, performance measures, targets, and milestones for meeting each program objective. This will include providing guidance and implementing policies and procedures, and providing suggestions and backup for changing policies. Changes affecting policy, funding and fiscal budgets will require Steering Committee (see section 1.4.2) input and approval. The Implementation Team will meet monthly, or as needed to meet its responsibilities.

The Implementation Team is comprised of technical staff selected by the Steering Committee, representing the following divisions or sections:

- Construction
- District Maintenance
- Environmental Services
- Federal Highway Administration
- Headquarters Maintenance
- Hydraulics
- Materials
- Roadway Design
- Specifications

A chairperson for the team is responsible for distributing agendas and minutes for meetings, and will be the point of contact for the Steering Committee. The chairperson will typically serve for one calendar year, at the end of which a new chairperson can be selected.

1.4.2 WQESC Steering Committee Responsibilities

The WQESC Steering Committee is comprised of Assistant Directors, Division Heads, and Assistant District staff representing the divisions and sections listed above for the Implementation Team. They will authorize additional or continued resources as needed to maintain or enhance the program objectives, and support or take corrective action based on the Implementation Team's input. The Steering Committee will meet quarterly, or as required to meet the WQESC program requirements. The Implementation Team members will attend these meetings, and will provide the agenda and information to be discussed.

Section 2
Storm Water Quality Considerations During Project Planning

2.1 Introduction

This section presents information to help project engineers and planners in defining and avoiding potential water quality impacts from NDOT projects during the planning phase of a project. Guidance is also provided for evaluating the need for permanent (design) BMPs in NDOT projects and for identifying these controls during the planning phase.

Preliminary sizing, use and placement guidance is provided for permanent BMPs that require more advanced planning such as infiltration or detention basins. Additionally, NDOT procedures for defining design responsibilities of temporary (construction site) BMPs and estimating their costs are outlined.

Storm water quality must be considered during all stages of project planning (e.g. Planning Studies, Purpose and Need Statements, Alternative Design Field Studies [ADFS], Preliminary Design Field Studies [PDFS], Environmental Documents, and other scoping documents). The primary storm water quality objectives during the project planning phase are to:

1. Identify potential storm water quality impacts and develop/evaluate options to avoid, reduce, or minimize the potential for these impacts;

2. Ensure that the programmed project includes sufficient right-of-way and budget for the required storm water controls;

3. Identify project-specific permanent and temporary BMPs that may be required to mitigate impacts.

Table 2-1 summarizes the storm water related activities that should be performed during the project planning process to meet these objectives. The remainder of Section 2 explains these activities in detail. The responsibility for storm water quality planning is shared mainly among the NDOT Hydraulics Section and Environmental Division with input from Roadway Design and Maintenance Sections.

Table 2-1
Storm Water Related Activities During Project Planning

- Determine potential storm water quality impacts associated with the proposed project and develop/evaluate options to avoid or reduce these impacts
- Review the regulatory requirements and findings from environmental studies to determine which project-specific storm water controls (permanent and temporary) are required. (i.e. mitigation requirements from the NEPA process)
- Develop preliminary size, location and cost of permanent controls (e.g. infiltration and detention devices) – if needed
- Develop planning-level cost for construction site (temporary) BMPs
- Incorporate findings into a final report or scoping document

2.2 Defining and Avoiding Potential Impacts

The project planning phase provides the greatest opportunity to avoid adverse water quality impacts as alignments and right-of-way requirements are developed and refined. Avoiding impacts may reduce or eliminate the need for permanent treatment controls and other mitigation-type BMPs. (See Section 2.3 for identifying and avoiding potential impacts.) By addressing these issues during this phase of the project, right-of-way and easement needs and their estimated costs can be defined so that property acquisition issues do not delay or prevent project construction.

2.2.1 Defining Potential Impacts

In many areas of Nevada the need for physical water quality BMPs is limited because of minimal precipitation and lack of direct discharge to receiving waters. In these areas, more appropriate temporary BMPs may be limited to proper construction scheduling, sweeping, and general site housekeeping. Permanent controls in these areas are typically limited to soil stabilization to comply with the NPDES and air quality regulations.

To conserve resources and reduce unnecessary placement of BMPs, the following process has been developed to evaluate the need for these controls in NDOT projects. This process generally involves the following steps:

- Consideration of the project's location with respect to sensitive receiving waters,
- Evaluation of other project specific characteristics that may influence BMP requirements,
- Review of current regulations for any additional BMP requirements.

The primary consideration in determining the nature and extent of BMP implementation is the project's location. Figure 2-1 is a map that identifies water bodies known to be impaired as defined by Nevada's 2002; 303(d) list (see

Section 2.3.3). For clarity, the map only includes waters impaired by pollutants that are most commonly generated by transportation facilities and their construction (i.e. sediment and turbidity). It is important to realize that the list is updated every two years and that additional water bodies are 303(d) listed as impaired by other pollutants that are not typically generated by transportation projects. For a complete listing of impaired waters and their pollutants of concern, the 303(d) list is available from the NDEP website or by contacting the NDEP Bureau of Water Quality Planning. The 2004 303(d) list is in draft form and should be released by the next Manual revision.

If projects fall within the identified areas in Figure 2-1, implementation of more comprehensive temporary and/or permanent water quality BMPs (e.g. water quality detention basins, etc.) should be considered. For projects outside these areas, permanent erosion control measures may still be needed and temporary construction BMPs will need to be implemented as appropriate for site conditions. It is also important to remember that even though a project may have little to no potential water quality impacts, wind erosion and impacts to air quality may still require temporary and permanent stabilization measures.

After considering the project's general location, more specific project characteristics should be evaluated. Table 2-2 identifies many of the project features and potential impacts that should be considered for each project or alternative. The Project Coordinator or Project Manager should confer with other sections or divisions, such as Landscape Architecture, Hydraulics, Environmental, Right of Way, Materials, Construction, and Maintenance, as needed to accurately identify and define these items. This will usually be accomplished by submitting the Project Categorization Score Sheet (see Section 2.5 and Appendix A), layouts/base maps, environmental documents, and other information to Hydraulics and Environmental to determine potential water and air quality impacts and appropriate control measures.

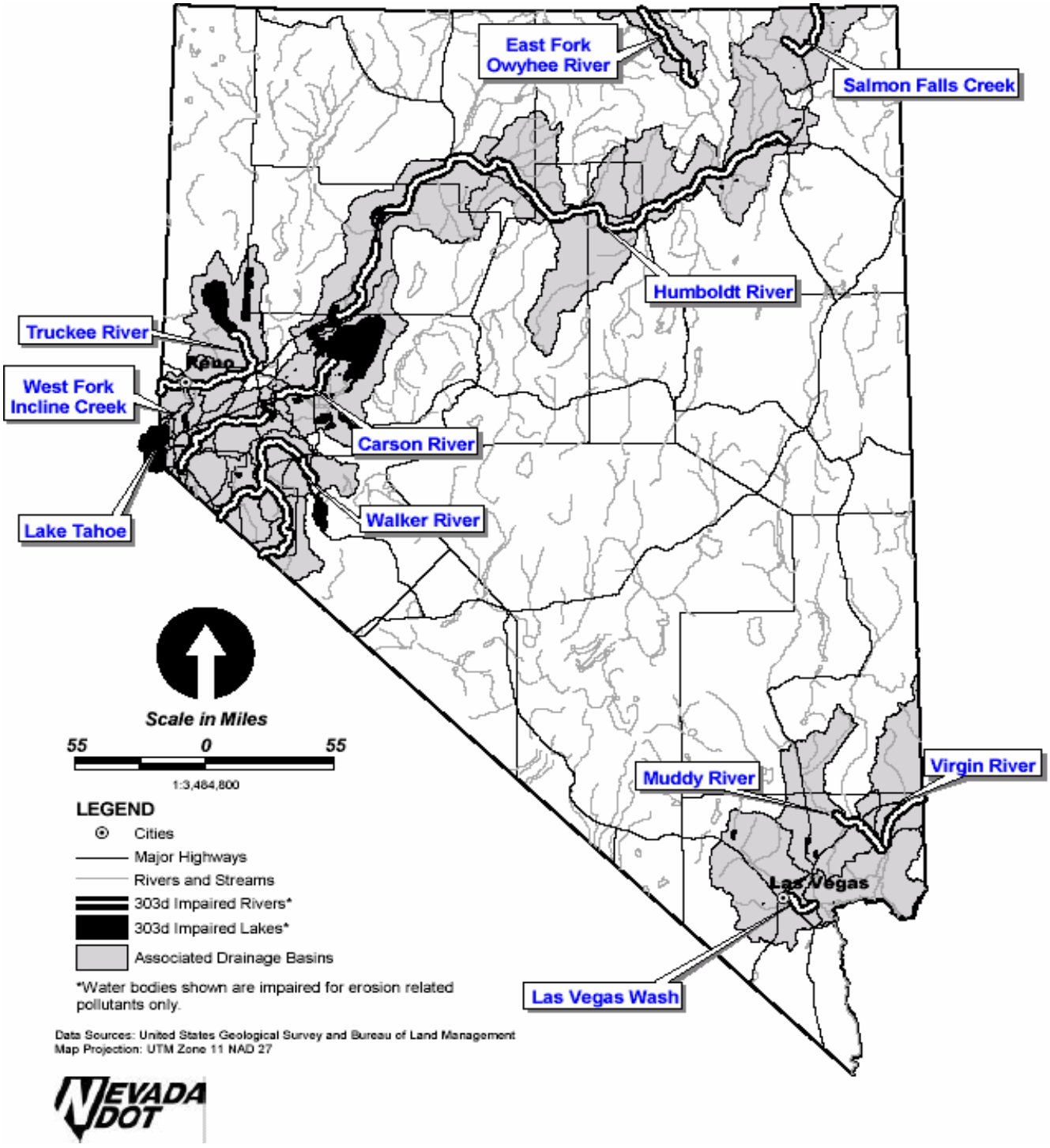


Figure 2-1
State of Nevada 2002, 303 (d) Listed Waters

Table 2-2
Project Features and Potential Impacts to be Considered During Project Planning

Features and potential impacts to be considered	Reasons why they must be considered
Special regulatory requirements (e.g. Treatment of 20–yr., 1–hr. storm in Tahoe Basin)	May impact permanent and temporary BMP requirements.
Identify receiving waters and all other waters that may affect, or may be affected by, the project. Consider aquifers, wells, streams, lakes, reservoirs, wetlands, and waters both fresh and saline. Consider impacts throughout the project's lifecycle, including construction, maintenance, and operation.	It is the first step in identifying impacts and potential control measure requirements.
Will construction require work in, above, or directly adjacent to the water bodies listed above?	Could require additional environmental permits/agreements and control measure requirements.
Are any of the receiving waters or watersheds a source for domestic water supplies?	
Are any sensitive fisheries, wildlife, recreational, agricultural, or industrial aquatic resources located in the vicinity of the projects? Will the project disturb the migratory path of birds or waterfowl? Will project cause any problems either during or after construction to fish passage?	
Are any of the receiving waters impaired (303d listed) for sediment, silt, turbidity, or clarity? (Discharges to impaired water bodies may be subject to strict numeric water quality standards and prescribed treatment controls.)	Supplemental controls may be required to further reduce pollutants, meet numeric water quality standards, waste load allocations, or requirements of an adopted watershed plan.
What is NDOT's contribution, expressed as a percentage of total flow, to receiving waters that are impaired or "sensitive"?	Used to determine if permanent treatment controls are required.
What is the unit cost for additional right-of-way (easements, acquisitions) should it be needed for treatment controls?	Used to estimate costs if temporary and / or permanent treatment controls are required.
Will the project increase the potential for downstream erosion by adding impervious surfaces, decreasing the time of concentration, or redirecting flows?	May need to implement detention devices to prevent damage to off-site stream banks or channels.
Does the project discharge to lined, engineered drainage facilities or unlined, natural channels?	Consideration for implementing detention device for stream bank protection.
Identify general soil types and vegetation within the project site.	Basic information needed for geometric and slope design and slope protection plans.
How difficult will it be to re-establish vegetation following construction?	
How long will it take for the new vegetation to establish?	
What are the steepest slopes that should be allowed?	
What vegetation, if any, should be preserved?	
Determine the general climate, annual rainfall, and typical seasonal rainfall patterns for the project area.	
Determine the proposed project slopes, and areas of cut and fill.	
Does the project include contaminated or hazardous soils or groundwater as identified in the initial site assessment or environmental documents?	May impact project construction activities and deployment of temporary controls during construction.
Will the contractor's yard be located within the State's right-of-way or otherwise be arranged for or provided by NDOT? If so, What are the potential impacts?	May impact deployment of temporary controls during construction.
Do seasonal construction restrictions exist? (e.g. Lake Tahoe grading season is from May 1 to October 15)	May impact project construction activities and deployment of temporary controls during construction.
Is the project located in an area where special air quality regulations are in place (e.g. Clark County PM-10 Regulations)	May impact post-construction permanent soil stabilization requirements

2.2.2 Options for Avoiding or Reducing Potential Impacts

Table 2-3 provides guidelines for consideration to avoid or reduce potential water quality impacts identified under Section 2.2.1. These planning considerations should be weighed carefully through a collaborative process among all of the involved NDOT divisions. Cost–benefit analyses and other evaluations will affect the feasibility of implementing these alternatives and decisions must be made through the proper and established NDOT procedures.

Table 2-3
Guidelines for Avoiding or Reducing Potential Impacts During Project Planning

Relocate or realign the project, while upholding safe design standards, to avoid or reduce impacts to receiving waters.
Design or locate structures and bridges to reduce work in live streams and minimize construction impacts.
Adjust the horizontal and vertical alignment, without jeopardizing safe design standards, to minimize erosion from slopes.
Disturb existing slopes and other soil areas only when necessary.
Minimize cut and fill areas to reduce slope lengths.
Consider retaining walls to reduce the steepness of, or shorten, exposed slopes.
Acquire right-of-way easements (such as grading easements) to reduce steepness of slopes.
Avoid soils or formations that will be particularly difficult to re-stabilize.
Provide cut and fill slopes flat enough to allow re-vegetation and limit erosion to pre-construction rates.
Provide benches or terraces on long cut and fill slopes to reduce concentration of flows.
Provide rounding and shaping of slopes to reduce concentrated flow.
Collect and convey concentrated flows in stabilized drains and channels.
Retain natural vegetation where feasible.
Utilize alternative materials or facilities to reduce future maintenance impacts on water quality (i.e. use of textured concrete in lieu of painted materials).
Schedule and/or phase the project to minimize soil-disturbing work during the rainy season.
Install permanent storm water controls (especially basins) and conveyance systems early in the construction process to provide additional protection and to possibly utilize them in addressing construction storm water impacts.

2.3 Review Requirements from Environmental Studies and Permits to Determine if Additional Project-Specific Controls are Required

During early project planning, storm water activities focus on identifying and avoiding impacts where practical and, if necessary, cost effective incorporation of permanent treatment BMPs into the project that may require additional right-of-way. This identification, avoidance, and incorporation process continues during the environmental studies phase, to determine if treatment controls or additional mitigation-type BMPs will be required.

Issues that are identified during environmental studies or project scoping may result in the need for project-specific permanent or temporary BMPs. Table 2-4 describes some of the typical issues that should be considered during the environmental studies phase. Much of this information will become available during studies performed for the National Environmental Policy Act (NEPA) process.

Where special water quality issues are present, the Project Manager/Coordinator should coordinate with NDOT Hydraulics and Environmental staff. For most NDOT projects, water and air quality controls are developed on a case-by-case basis through coordination and discussions with involved agencies.

Table 2-4
Environmental and Permit Issues

Environmental or Permit Issues that May Require Project-Specific Permanent BMPs	Environmental or Permit Issues that May Require Project-Specific Construction Site (Temporary) BMPs
Significant, unavoidable impacts to receiving waters	Significant, unavoidable impacts to receiving waters
Discharges of dredge or fill material into navigable waters (404 Permit/401 Certification)	Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification)
Working in Waterways Permit (Rolling Stock Permit) for work within, next to, or immediately adjacent to live streams or water bodies.	Working in Waterways Permit (Rolling Stock Permit) for work within, next to, or immediately adjacent to live streams or water bodies.
Post-construction dewatering requirements	BMPs for stockpiling, handling, and transporting contaminated soils
Variances for lead contaminated soils	BMPs and local permits for temporary construction dewatering
BMPs to meet numeric standards for an impaired (303d listed) water body	Project-specific for specifying temporary BMPs
Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or ground water recharge facilities (well head protection areas)	Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or ground water percolation facilities (well head protection areas)
Specific NDEP requirements	Specific NDEP requirements

It is important to note that if a project is delayed or shelved permits can expire and must be re-evaluated, re-issued, or renewed. If this occurs, the Project Manager/Coordinator should consult with the Environmental Division Staff to verify permit compliance.

The following sections discuss regulations and permits that may require the incorporation of permanent pollution control BMPs into NDOT projects. Table 2-5 summarizes the currently defined permanent air and water quality control requirements for NDOT projects.

2.3.1 Circumstances for Considering Treatment Controls

This section summarizes the various regulatory and permitting situations that may require permanent treatment controls to be included in projects.

2.3.1.1 NDOT Policy and NEPA

NDOT's general policy for including permanent treatment controls is to consider treatment devices (i.e., infiltration and detention basins) for water quality control if major sediment transport is expected and would have a considerable impact on streams, lakes, or adjacent property. This policy is in general agreement with NEPA.

NDOT projects are subject to NEPA requirements when Federal actions or funding are involved. Permanent treatment control BMPs may be required if the NEPA process determines that the project causes significant, unavoidable impacts to receiving waters without incorporation of such controls in the project. For additional information on the NEPA process see Section 1.

2.3.1.2 Discharges of Dredged or Fill Material into Navigable Waters (404 Permit/401 Certification)

Projects that discharge dredged or fill materials into navigable waters are required to obtain a Section 404 permit from the US Army Corps of Engineers, and a 401 Water Quality Certification from the NDEP. Site-specific BMPs may be required for 401 certification to address discharges during construction and operation. For detailed information on 404/401 regulations, see Section 1.

2.3.1.3 Section 303(d) Listed Waters

Section 303(d) of the Clean Water Act requires states to identify waters that do not meet State water quality standards even after pollution point sources have been addressed with appropriate controls. Once a water body is listed as impaired, states must establish a Total Maximum Daily Load (TMDL) to define how much of the pollutant can be discharged to the water body without exceeding the water quality standards. The TMDL is then used to allocate pollutant loads, or Waste Load Allocations (WLAs), among the identified pollution sources in a watershed. To date NDOT has not been assigned any Waste Load Allocations (WLAs) to control pollutant discharge to an impaired water body. It is possible that in the future NDOT may be

required to participate in the development of TMDLs and WLAs that may affect future permit requirements for NDOT discharges. Under the current TMDL program, numeric standards for storm water runoff have not been developed in Nevada because storm water runoff from highways and highway facilities is highly variable. To address highway runoff, the NPDES program has emphasized implementation of BMPs and monitoring.

In Nevada, there are two established TMDLs for Total Suspended Solids (TSS) for the Walker and the Humbolt Rivers. In regards to both of these TMDLs, the director of the NDEP has stated that the existing TMDLs oversimplify a complex situation and do little to characterize sources to the level needed for a meaningful implementation plan. Additional work is needed to better identify sources in terms of their contributions and locations, and to better characterize beneficial use impairment (particularly aquatic life).

NDEP is currently studying these rivers to identify sources, contributions, and locations and to better characterize the impairment to the river's beneficial uses. Additional TMDLs for sediment and other erosion related pollutants are currently being developed for Lake Tahoe, the East Fork Owyhee River and Mill Creek.

Where TMDLs have not been developed for waters that exceed state water quality standards and the water is 303(d) listed or otherwise determined to be impaired, NDOT will support watershed planning efforts to identify additional controls that may be necessary to prevent or reduce discharges of the target pollutant from the completed project. The 303(d) list is updated by the NDEP every two years and the most current version is available from their website or by contacting the NDEP Bureau of Water Quality Planning. The 2004 303(d) list is in draft form and should be released by the next Manual revision.

2.3.1.4 Permanent BMPs Prescribed by Other Permits

Other state and local permits, as outlined in Section 1, may also require that permanent water and/or air quality controls be included in the project. These include the NDEP General Construction and MS4 Permits, Clark and Washoe County dust control and emissions regulations, and Irrigation District licensing. Table 2-5 below summarizes the currently defined permanent air and water quality control requirements for NDOT projects.

Table 2-5
NDOT Project Requirements

Agency	Permit/Regulation	Permanent water/air quality control requirements
NDEP	General Construction Permit	■ 70% re-establishment of pre-construction perennial vegetation or other appropriate measures
NDEP	MS4 Permit	■ Development of a Storm Water Management Plan
TRPA	Code of Ordinances	■ Retain and treat 20 Year/1 Hour Storm ■ EIP Implementation
Clark County	Air Quality/Dust Control	■ Dust Control Plan for soil disturbances greater than ¼ acre ■ Dust Mitigation Plan for projects larger than 10 acres ■ Dust Control Monitor for projects larger than 50 acres
Washoe County	Air Quality/Dust Control	■ Dust Control Plan for soil disturbances greater than 1 acre
Irrigation Districts	Irrigation District Construction Licenses	■ Bank stabilization when working over irrigation ditches
USACE	Clean Water Act Section 404 Permit*	■ Any final stabilization or other pollution control as required by the specific permit
NDEP	401 Water Quality Certification	■ Temporary erosion and sediment controls
NDEP	Temporary Work in Waterways/Discharge Permit (Rolling Stock Permit)*	■ Any final stabilization or other pollution control as required by the specific permit
NDEP	Dewatering Permit*	■ Any final stabilization or other pollution control as required by the specific permit

* These permits typically have no permanent BMP requirements; however, permits are issued individually and should be carefully reviewed to insure compliance with all requirements.

2.4 Preliminary Sizing for Permanent Treatment Control Devices

Section 2.3 discussed determining when treatment control BMPs (e.g. infiltration and detention basins) may be required for storm water pollution control as identified by reviewing the project's characteristics, the environmental documents and other prescriptive permit requirements. Treatment control BMPs are intended to improve water quality by treating storm water prior to discharge. Treatment devices may also be required to provide hydrologic control to prevent increased peak flow rates and erosion in downstream watercourses as a result of increases in magnitude and frequency of storm flows.

If it is determined, by Hydraulics and Environmental, that treatment control BMPs are required, the scope of work, right-of-way needs, and cost estimates should be identified as soon as possible in the planning stage of the project. This information is required to be accurate and complete by the 60% design stage. The Project Manager/Coordinator should coordinate with the Landscape Architect to determine

aesthetic aspects of basin location and layout, and follow the respective working details in Appendix B for more detailed design guidelines.

When permanent treatment control devices are required, consider the following:

- Availability of suitable land
- Peak discharge rate to downstream watercourses
- Maintenance access and costs. District Maintenance should be consulted when these devices are designed.
- Soil conditions appropriate for the BMP. Check with the Materials Division for project-specific soil conditions.

A reasonable design goal for hydrologic erosion control (stream or channel erosion control) is to limit the peak runoff rate for a 2-year storm to the pre-development rate, thus reducing in-stream channel erosion problems. Note that this design goal is different from, and in addition to, the flood control design requirements in NDOT drainage design manual.

See the working details for treatment control BMPs in Appendix B and the sizing example in Appendix C for guidance. The resulting facility size(s) should be used as a basis for developing cost estimates and right-of-way requirements for inclusion in the 60% Design Report.

2.4.1 Treatment BMP Use and Placement Considerations

Several factors must be considered to determine which BMPs are suitable for a given application. Site-specific conditions can affect operations, maintenance, construction costs, safety, and aesthetics. The Project Manager/Coordinator together with the Hydraulics Section must determine if sufficient right-of-way is available for the desired BMP, or if the benefits associated with a potential BMP justify the consideration of acquiring additional right-of-way.

The physical dimensions of a BMP may have an important bearing on the factors identified in this section. The size of many BMPs is determined by the amount of runoff the system will be required to treat. The amount of runoff is affected by the location, land use, drainage area, storm intensity, topography, soil characteristics, and the extent of impervious areas. For the design of infiltration or detention basins, Hydraulics staff should be consulted.

Both storm volume and peak flow conditions must be considered in the evaluation of runoff conditions. Unlike flood control measures that are typically designed to store or convey the peak flow rates or detain sufficient volume to reduce the peak flow rate of infrequent storm events, treatment BMPs are designed to treat the runoff of more frequent much smaller storm events. The target treatment volume or flows associated with the frequent events are commonly referred to as the Water Quality Volume

(WQV) for BMPs designed based on volume, and Water Quality Flow (WQF) for BMPs designed based on flow.

Treatment BMPs are sized to accommodate the WQF or WQV from the contributing drainage area. Flows in excess of these values are diverted around or through the treatment BMP. Methods for determining the WQV are generally tied to an analysis of rainfall depths generated over 24-hour periods (with the exception of Lake Tahoe where the 20-year, 1-hour event is used). WQV is used to size infiltration, detention, and retention treatment control devices. See Appendix C for a WQV design example that utilizes the Rational Method.

The WQV of Treatment BMPs is based on using either of the following methods:

- Where they are established, sizing criteria from local regulatory agency will be used (currently only the Lake Tahoe Basin has established a basis for calculating the WQV); and

- Where no sizing criterion is established, the following method is recommended:

The maximized detention volume is determined by the 85th percentile runoff capture ratio. This method is described in Chapter 5 of the *Urban Runoff Quality Management WEF Manual of Practice No. 23,* 1998, published jointly by the Water Environment Federation (WEF) and the American Society of Civil Engineers (ASCE). This method requires the designer to assume a drawdown time. Drawdown time between 2 and 7 days can be used (the 2 day limit provides adequate settling and the 7 day maximum addresses vector concerns).

Alternatively, a WQV may be established by NDOT, subject to the review and approval of the NDEP and other involved agencies, if the site area is limited and cannot accommodate a treatment BMP sized according to the method described above.

The WQF is the primary design criteria used for various types of flow-through treatment control devices, such as swales, sand traps, and gross solids removal devices (GSRDs). Various methodologies exist for calculating the WQF and the approved methods are listed in the NDOT Drainage Manual. The Rational Method is probably the most common but its use is limited to watershed drainage areas of 200 acres or less. Intensity, duration, frequency (IDF) curves, or basin specific standards, provide values of rainfall intensity to be used in the Rational Formula (Q=CiA) to estimate peak flow runoff from areas discharging to the treatment device. Resulting runoff rates would be the design WQF to be used at any specific site.

In addition to designing for the WQF, the Hydraulics designer must also insure that flow-through treatment devices include a bypass or an overflow device to convey peak discharges from larger design storms consistent with Table 6.1 of the NDOT Drainage Manual.

2.5 Planning Level Cost for Construction Site (Temporary) BMPs

NDOT has adopted a policy of categorizing all construction projects as having no, low, medium or high potential for water quality impacts based on the results obtained from completing the Project Categorization Score Sheet. The score sheet and supplemental instructions for completion are included in Appendix A. Project Category general definitions are as follows:

- **No impact**: Projects with ground disturbance less than one acre or no potential discharge into Waters of the U.S. (WOUS).

- **Low Impact**: Projects usually with less than one acre ground disturbance and low potential for discharge of sediment into WOUS.

- **Medium Impact**: New construction or reconstruction projects with potential discharge of sediments into a WOUS. Ground disturbance is not excessive, construction phasing is simple, and construction duration is usually less than two years.

- **High Impact**: Projects with major ground disturbance, high potential of sediment discharge, complex construction staging, and construction duration may be longer than two years. All projects in the Lake Tahoe Basin are classified in this category.

To establish planning level costs, an initial pass through the score sheet should be made during the planning phase and cost estimates developed as follows:

- **No Impact Projects:** Include 637 0003 Temporary Pollution Control (Lump Sum) in the amount of $500 in the project estimate.

- **Low Impact Projects:** Include 637 0003 Temporary Pollution Control (Lump Sum) in the amount of $5,000 in the project estimate.

- **Medium Impact Projects:** Include 637 0003, Temporary Pollution Control (Lump Sum) in the project estimate according to Table 2-7 below.

- **High Impact Projects:** NDOT's Hydraulic section may develop an estimate based on an assumed phasing sequence, and include bid items in the final PS&E document. Plan sheets may be developed to show anticipated BMPs for one of the phases from the assumed sequencing, which the contractor can use in developing the Storm Water Pollution Prevention Plan. A table can be provided to show estimated quantities for the phases not shown on the plans. There may be instances for which utilizing the lump sum item and refraining from plan development will be more appropriate. The Hydraulics Section will consult with Construction for their input early in this process. As an initial guideline refer to Sections 2.5.1 and Table 2-6 below.

A second, more detailed, pass through the score sheet is made during the design phase (see Section 3) after drainage areas and other project characteristics are more accurately defined. The second pass is used to make the final determination of who will be responsible for the design of the temporary BMPs.

The project cost should include estimates for SWPPP development and estimates to implement construction site BMPs during project construction as required by the Permit. Provided below are guidelines that will assist designers in estimating the planning level costs to implement (i.e., construct, maintain, and remove) construction site BMPs.

2.5.1 Estimating Cost for Implementation of Construction Site BMPs

Planning level BMP implementation costs can be estimated from Table 2-6. These same estimated costs will be included in the engineer's estimate for the lump sum Temporary Pollution Control bid item for No, Low, and Medium Impact projects, as determined by the Project Categorization Score Sheet. Planning level cost for implementation of construction site BMPs on High Impact projects can be calculated as a percentage of total construction costs. This estimate will typically be replaced with BMP bid items in the Plans, Specifications and Estimate (PS&E). In general, higher elevations and higher annual rainfall totals will result in higher construction site BMP costs.

Table 2-6
Estimated Cost for Implementation of Construction Site BMPs

Type of Project		Temporary Pollution Control (TPC) Estimate
No Impact	Projects disturbing less than one acre, no discharge to WOUS	Include $500 Lump Sum
Low Impact	Projects with little disturbed area, low potential for water quality impacts	Include $5,000 Lump Sum
Medium Impact	Projects with moderate disturbed area, simple phasing	See Table 2-7 below for Lump Sum estimate
High Impact (Planning level cost only)	Projects within the Lake Tahoe Basin	2% of construction estimate ($15,000 min.)
High Impact (Planning level cost only)	Projects with considerable staging, borrow/fill sites and projects requiring significant import or export of soil material	0.5% of construction estimate ($30,000 min.)

If the project is categorized as Medium impact per the Project Categorization Score Sheet found in Appendix A, Temporary Pollution Control will be paid with a lump sum bid item, the amount of which will be estimated from Table 2-7 below. Table 2-7 should be used in the following manner:

Column 1 Select a project type that most closely represents the subject project.
Column 2 This column represents the TPC cost of a typical project in this category.
Column 3 If the construction duration spans two wet seasons as defined in the BMP Manual, increase the TPC estimate by $5,000.
Column 4 If commitments or requirements by another governing entity dictate more effort than the BMP Manual minimum implementation requirements, coordinate the TPC estimate with the Hydraulic Engineer. This will rarely be necessary.

Table 2-7

Temporary Pollution Control (TPC) Lump Sum Estimate for Medium Impact Projects

Project Type	Typical Project TPC Estimate	2 Wet Season Construction Duration*	Commitments / Requirements Above Manual Minimums
Small – Medium Widening 3R w/ Drainage Improvements	$15,000	Add $5,000	Coordinate TPC Estimate with Hydraulics Engineer
Bridge over Creek or River New Alignment Roadbed Mod/Crack & Seat Small-Medium Interchange Over/Undercrossing	$25,000	Add $5,000	

*See BMP Manual Section 2.3.4 for Wet Season determination.

2.5.2 Estimating Costs for Air Quality BMPs

For the purpose of planning level costs, a lump sum prorated item 6370090 for Dust Control has been set at $1,000 plus 0.1% of total project costs and is included in all projects statewide. NDOT's estimating system calculates and includes this item automatically. This includes considerations for developing dust control plans, acquiring and applying dust control products, and meeting all state and local permit requirements. Permanent soil stabilization measures will be a separate bid item payment, to be included in the Plans, Specifications and Estimate (PS&E).

2.6 Incorporate Results into Final Report or Scoping Document

The information collected and developed during the planning phase will provide the basis for detailed design during the PS&E phase. All data, decisions, and assumptions must be carefully documented by the Project Manager/Coordinator and included in the final report or scoping document.

Section 3
Storm Water Quality Considerations During Project Design

This section presents design guidance for incorporating storm water pollution controls in the Plans, Specifications and Estimates (PS&E) and performing other storm water related activities for NDOT projects. The primary objectives during this phase are to:

- Make a final determination of the permanent BMPs required for the project and the feasibility of including such controls,
- Develop the necessary information to design the permanent BMPs,
- Address the need to include construction site (temporary) BMPs in the bid documents

The storm water related activities to accomplish during the project design phase are shown in Table 3-1:

Table 3-1
Storm Water Related Activities
During Project Design

- Delineate drainage areas and define total disturbed area
- Review and update the determination of the need for treatment controls
- Define climatic conditions of the project
- Determine site hydrology
- Apply general design practices and design permanent BMPs
- Determine need to design and specify Construction Site (Temporary) BMPs
- Prepare Storm Water Quality Special Provisions
- Prepare Supplemental Storm Water Quality Information for Construction Phase

A detailed checklist of these storm water related activities, and responsibilities for their completion, for use during project design is provided at the end of this section (Table 3-5). The checklist in Table 3-5 may be used by the Project Manager/Coordinator as a check that the important storm water issues have been addressed. This checklist is not a mandatory part of all project files, but is intended to provide an additional level of quality control for more environmentally sensitive projects.

3.1 Delineate Drainage Areas and Define Total Disturbed Area

Various characteristics of the project drainage area can influence the project's potential to impact water quality and the associated water quality controls that will be required. This section outlines procedures to characterize and define the project drainage area to provide information to be used in the design of water quality controls.

3.1.1 Delineate Drainage Areas

Delineate the drainage information shown in Table 3-2 on the drawing(s) of the drainage system. Show both pre-project and post-project drainage, if possible, on the same drawing; or if necessary for clarity, on separate drawings. Also, this information can be supplied as part of the storm water quality information package, or can be used to create SWPPPs (see Section 3.8).

Table 3-2
Features to Show On Drainage Area Drawings

Drainage areas	Existing and Planned Drainage Facilities
■ Drainage boundaries & areas to each outfall (on-site and off site) ■ Drainage pattern arrows for overland flow	■ Curbs/Inlets ■ Underground storm drains ■ Ditches/swales ■ Channels ■ Basins and other flow controls ■ Drainage outfalls from structures (i.e. bridges) ■ Streams and Lakes

3.1.2 Define Total Disturbed Area

Estimate the total area of soil disturbance expected to result from construction activities related to the project. A preliminary estimate should be made in the planning phase in order to assess the project's potential for water quality impact (see Project Categorization Score Sheet, Appendix A). A revised calculation should be made at 60% to confirm the Score Sheet impact level, and additionally when changes are made that could effect the Impact Level. The following are examples of areas that should be included in the estimate of land likely to be disturbed by construction activities:

- Areas to be cleared and/or grubbed
- Areas to be excavated, filled, or otherwise graded
- Areas designated for construction staging or storage, if soil is exposed

- Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed
- Areas of utility relocation

3.2 Review and Update the Need to Consider Storm Water Quality Treatment Control BMPs

The following steps should be taken to confirm the need for treatment controls before beginning the final design process.

1. Determine, on a drainage area basis, the need to consider storm water controls on the project using the protocol laid out in Section 2.3.

2. If it is determined that treatment controls must be considered, the procedure described in Section 2.4 for preliminary sizing of treatment control facilities can be used to determine an approximate area required.

3. Include items that have been confirmed as being required for the project in the final design.

3.3 Define Climatic Conditions

The following climatic data must be collected to aid in the selection and design of storm water pollution controls:

- **Average Annual Rainfall and Evaporation.** This information is required for the design and specification of vegetative erosion controls. It is necessary to determine whether there is sufficient moisture naturally to maintain the vegetation in a sufficiently healthy state to serve the intended purpose or whether supplemental watering will be needed. The General Permit states that in arid areas (areas with an average annual rainfall of 0 to 10 inches), semi-arid areas (areas with an average annual rainfall of 10 to 20 inches), and areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable. Arid areas are generally located in southern Nevada and low-lying areas of northern Nevada, while semi-arid areas are typically located in northern Nevada. For information regarding Nevada's climate and revegetation guidance, see *University of Nevada Reno's Mapping Ecosystems Along Nevada Highways and the Development of Specifications for Vegetation Remediation,* and the National Weather Service's Climate Prediction Center.

  The State of Nevada's average annual precipitation is shown in Figure 3-1. Figure 3-2 shows average annual evaporation for the State of Nevada.

- **2-Year Storm.** This storm, defined by Intensity-Duration-Frequency (IDF) curves, is recommended for use in checking for erosive velocities in earthen channels and in receiving waters.

- **Treatment Design Storm.** This information is needed if treatment controls are to be considered, and is used in conjunction with required sediment storage volumes to determine the volume of the treatment device. See Section 2.4.

- **20-year, 1-hr Storm**. This information is needed for projects in the Lake Tahoe Basin to determine the treatment design storm. For projects in the Lake Tahoe Basin, it may be assumed to be equal to one inch of rain falling in one hour (assumption valid in the Lake Tahoe Basin only).

3.3.1 Rainy Seasons

The state of Nevada can be divided into three different rainfall regions as shown in Figure 3-3, which was adopted from the 1986 NDOT *Roadway Design Manual*. The rainfall season in Nevada is from October 1st to May 1st; however, the average annual rainfall amounts vary by region. The Sierra Nevada region is subject to floods in the late fall and winter from rain and snowstorms from the Pacific Ocean. The Northern Nevada region is subject to winter snow and the resulting snowmelt runoff. Southern Nevada storms, observed mainly in the summer months, are usually generated by rainstorms from the Gulf of Mexico or the Pacific Ocean. The Project Manager/Coordinator should check with the Hydraulics Division for any specific requirements and verify that the necessary edits are made in the Contract Documents.

3.6 Determine Need to Design Construction Site (Temporary) BMPs

Project-specific conditions and NDOT policy will determine:

- The level of temporary BMP implementation,
- The responsibility for temporary BMP design, and
- The method of payment for temporary BMPs.

Some regions (i.e. Lake Tahoe) have adopted regulations requiring NDOT to incorporate construction site (temporary) BMPs into bidding information materials or into the PS&E.

3.6.1 Project Categorization Score Sheet

The Project Categorization Score Sheet discussed in Section 2.5 and provided in Appendix A, should be updated during final design after drainage areas and other project characteristics are more accurately defined. For projects categorized as having low or medium potential impacts, the contractor is responsible for SWPPP development including design of temporary BMPs. See Section 1.2.2.1.2 for additional contractor responsibilities for General Permit compliance.

For projects categorized as having a high potential for water quality impacts, the Hydraulics Section or a contracted consultant will develop temporary erosion control plans for temporary BMPs for one possible construction phase and will include bid items to be included in the final PS&E document. These plans will then be used by the contractor's Professional Engineer (PE) to develop the SWPPP in compliance with the General Permit and the *Construction Site BMPs Manual*.

NDOT will include specific temporary BMPs in the design under any of the following conditions:

- The project is categorized as having high potential for water quality impacts,
- Specific construction site (temporary) BMPs are prescribed by the NDEP, TRPA, or other environmental permits or certifications,
- The NEPA process has identified sensitive receiving waters or valuable habitats requiring special protection.
- There are site-specific conditions or sources of pollution that would not be adequately addressed by "typical" SWPPP deployment strategies.

Designers should consult with the Hydraulics Section and Construction Division when specifying project-specific temporary BMPs and for specific cost estimation guidelines. For guidance on how to design construction site (temporary) BMPs, see the NDOT *Construction Site BMP Manual*. The Project Manager/Coordinator must

also keep in mind that in certain parts of the state (e.g. Tahoe Basin) the project may require scheduling or phasing to minimize or eliminate soil-disturbing activities during the rainy season.

For projects categorized as having a medium or high potential for environmental impacts, the Environmental Division is responsible for consulting NDEP and any other involved agencies prior to the 60 percent design level to determine any specific permitting requirements. The Project Manager/Coordinator must then see that any additional storm water quality controls as identified by NDEP are incorporated into the project plans.

3.7 Prepare Storm Water Quality Special Provisions

Special Provisions addressing specific project conditions may be necessary to supplement and modify Standard Specification Section 637 for temporary pollution control. Ensure that the contract documents clearly set forth the contractor's responsibilities. These responsibilities will include preparation and implementation of a SWPPP when the project will disturb one or more acres of soil, or if the project will disturb less than one acre but is in or near Waters of the U. S. A Special Provision for water pollution control has been developed specifically for this purpose.

The Water Pollution Control Special Provision includes a reference to the NDOT *Construction Site Best Management Practices Manual* for the minimum implementation of temporary BMPs.

3.8 Prepare Storm Water Quality Information for Construction Phase

Once the PS&E package is finalized, the Project Manager/Coordinator should prepare/develop a supplemental storm water quality information package. This information will be used by the contractor to prepare the final SWPPP and by the RE to help verify payment for the various storm water controls. Information which may be included in the storm water information package is listed below:

- The single phase temporary erosion control plans including general layout, locations, and limits for the BMPs identified in the PS&E (High impact projects only).

- A brief explanation of any construction site (temporary) BMPs that are specified in the PS&E.

- A description of permanent BMPs including an explanation of the technical basis used to select the practices to control pollution where flows exceed predevelopment levels. This information is required in the SWPPP.

- Any additional information that is necessary for the contractor to bid the project accurately and implement the required pollution controls during the construction project.

The checklist in Table 3-5 may be used by the Project Manager/Coordinator as a check that the important storm water issues have been addressed. This checklist is not a mandatory part of all project files, but is intended to provide an additional level of quality control for more environmentally sensitive projects.

Table 3-5
NDOT Storm Water Quality Handbooks – Planning and Design Guide
Check List for Storm Water Quality Activities During Project Design

Storm Water Quality Activity during PS&E	Completed	Date	Name
Delineate Drainage Areas (Hydraulics)			
Drainage Areas			
Drainage boundaries to each outfall			
Drainage area downstream each outfall (on-site and off-site)			
Drainage pattern arrows for overland flow			
Detention basins and other flow controls			
Existing and Planned Drainage Facilities			
Curbs/Inlets			
Underground storm drains			
Ditches/swales			
Channels			
Detention basins and other flow controls			
Drainage outfalls from structures (i.e. bridges)			
Define Total Disturbed Area (Roadway Design)			
Areas to be cleared and/or grubbed			
Areas to be excavated, filled or otherwise graded			
Areas designated for construction staging or storage, if soil is exposed			
Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed			
Areas of utility relocation			
Review and Update Need to Consider Storm Water Quality Treatment Control BMPs (Hydraulics)			
Determine, on a drainage area basis, the need to consider treatment controls on the project (Use the protocol laid out in Section 2.3.)			
If treatment controls must be considered, determine approximate area required.			
Incorporate items identified during the pre 60% NDEP consultation			
Define Climatic Conditions of the Project (Hydraulics)			
Mean Seasonal Rainfall and Evaporation			
2-year storm			
Treatment Design Storm			
20-year, 1-hour storm			

4.6.2 Integrating Treatment Controls with Other Facilities

In many instances, and especially in areas where available right-of-way is limited, treatment control BMPs can be integrated into common project features such as medians, shoulders, setbacks, interchange areas, landscaped areas, parking areas and unused right-of-ways. Treatment control BMPs may be considered for any available open areas alongside the road, but safety considerations and access for maintenance must be fully considered when selecting the location.

In some cases, drainage, flood control, and storm water pollution controls can be integrated into a single facility that achieves all objectives cost-effectively. The design guidelines laid out in the individual BMPs contained in Appendix B must be carefully followed to minimize the chance that the large storms used to size the drainage and flood control portion of these sediment basins do not "flush out" the pollutants previously captured and stored in the facility. Alternatively, the large storms may be bypassed around the water quality control facility.

Design and siting of storm water quality controls should be consistent with normal NDOT design and maintenance practices. Final layout and design of treatment controls must be coordinated with the NDOT Roadway Design, Right-of-Way, Landscape, District Maintenance, Environmental, and Hydraulics Divisions.

4.6.3 Detention Strategies

Where needed, combination drainage, flood control, and storm water pollution control basins must provide separate storage volumes and outlet controls for each objective, each sized as if they were separate basins and then "stacked" in a manner that meets all objectives as noted below:

- The objective of storm water detention for flood control, sometimes referred to as "peak shaving", is to reduce the peak rate of runoff from relatively intense, infrequent design storms (e.g., a 10-year storm or larger). Generally, the runoff from smaller storms passes through these basins without significantly altering the discharge hydrograph or removing pollutants.

- Storm water treatment controls employ a different storage strategy; they capture and detain almost all runoff from a water quality design storm that is typically much smaller than the flood control design storms while the larger, infrequent storms are bypassed.

4.6.4 Incorporating Maintenance Access

Treatment control BMPs will require on-going inspection and maintenance once construction is completed. The design staff should assemble information to be turned over to District Maintenance staff upon project closeout. This information should include O&M procedures for the permanent BMPs. Some of this information can be obtained from the Inspection and Maintenance sections of the BMPs found in Appendix B of this guide. Other information, such as site-specific access issues or special maintenance requirements, needs to be developed on a project-by-project basis.

Appendix A

This Appendix contains the following documents:

- Project Categorization Score Sheet and Instructions
- A copy of the NDOT/TRPA MOU
- A blank TRPA Initial Environmental Checklist
- TRPA Guidelines for Applying for a TRPA Permit for a Linear Public Service Project
- TRPA Guidelines for Exempt or Qualified Exempt Projects

Please Note: The Documents provided in this appendix may be subject to change. Copies of the most current documents can be accessed on the TRPA website.

Guideline for Project Categorization Score Sheet

The following information is intended to provide additional clarification and guidance for the completion of the NDOT Project Categorization Score Sheet.

Questions 1 and 2

The first two questions are intended to determine if the project may be categorized as having no impact to waters of the United States (WOUS) as defined in 40 CFR § 122.2. Projects with ground disturbance less than one acre or no direct discharge into WOUS may be placed in this category and it is then unnecessary to complete the remainder of the score sheet. Discharges to storm drain systems that in turn discharge to WOUS are considered to be discharges to WOUS. It is vitally important to evaluate the project for any conceivable discharge that may occur to WOUS including intermittent streams and/or ephemeral water bodies that are dry at the time of evaluation. NDEP may require General Permit coverage for a project not impacting a WOUS or that disturbs less than one acre, however this is rare. Coordinate the determination of WOUS impact with the Water Quality Specialist.

Disturbed soil areas (DSAs) are areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction. Disturbance is also defined as clearing, grading, or excavating underlying or surrounding soil as part of a repaving operation. Repaving areas that create fine-grained material (e.g. asphalt millings) that are not immediately disposed of or are stockpiled on site are considered DSAs. The following are examples of areas that should be included in the estimate of land likely to be disturbed by construction activities:

- Areas to be cleared and/or grubbed
- Areas to be excavated, filled, or otherwise graded
- Areas designated for construction staging or storage, if soil is exposed
- Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed
- Areas of utility relocation

Categorizing a project as having no water quality impacts should be carefully documented in the project files with a statement that justifies the finding and contains the name of the person responsible for this finding.

Question 3

This question is intended to quickly classify all Lake Tahoe projects as having a high potential for environmental impact.

Question 4

- Enter the score corresponding to the project's total disturbed area in acres.

Question 5

Identify the number of locations where storm water runoff leaves the construction site as a concentrated flow.

Question 6

Quantify the duration of construction in years. If the duration is over one year but only includes one wet season, round the duration down to one year. If the project spans two wet seasons round the duration up to two years. Use a similar methodology for longer-term projects.

Question 7

Estimate the steepness of the slopes in the areas where soil disturbance will occur. On many projects, the slope inclination varies, so use judgment in selecting the appropriate category. If unsure in selecting an appropriate slope, the average project slope can be calculated using a weighted average.

$$S_{avg} = \Sigma(S_i * A_i) / \Sigma A_i$$

Where S_{avg} = Average project slope

S_i = The slope of an individual area

A_i = The area (sq ft) for the given individual area

For example, assume a project was determined to have 12,000 sf of slopes at approximately 1.5:1, 2,500sf at 2:1, 1,500 sf at 3:1, 2,700 sf at 4:1, and 9,000 sf at 6:1. The average slope would be calculated as follows:

Slope	Area	Slope * Area
1.5	12,000	18,000
2	2,500	5,000
3	1,500	4,500
4	2,700	10,800
6	9,000	54,000
Total =	27,700	92,300

Using the equation above, the equation output would be 92,300 / 27,700 = 3.3, or a 3.3:1 average slope. On the Score Sheet, the category 2:1 < Slope < 4:1 would be selected since the average slope is between 2:1 and 4:1.

Project Categorization Score Sheet

Project Title	
Description	
Milepost	
Project ID	
Designer	
Date	

Note: See guidance in the Strom Water Quality Handbook *Planning and Design Guide* before filling out this Score Sheet

1	**Will the total disturbed area of the project be one acre or greater? If no, categorize project as having no impact**	**Yes** **No**	**Continue** **Stop**
2	**Is there any potential for runoff to discharge to live surface water bodies or Water of the United States? If no categorize project as having no impact (See Guideline, coordinate with Water Quality Specialist)**	**Yes** **No**	**Continue** **Stop**
3	**Is the project located in the Lake Tahoe Basin? If yes, categorize project as having high environmental impact, if no, then continue**	**Yes** **No**	**Stop** **Continue**
4	**Acreage of disturbed soil areas**	**0-1** **1-5** **5-10** **10-20** **20+**	**1** **2** **3** **4** **5**
5	**Will project discharge storm water runoff to a single location (A) or multiple locations (B).**	**A** **B**	**1** **2**
6	**What is the duration of construction? (See guidance on rounding in Guideline)**	**One year or less** **Two years** **More than 2 years**	**1** **2** **3**
7	**Characterize the slopes in the disturbed area**	**Slopes 4:1 (H:V) or flatter** **4:1 < Slopes < 2:1 (H:V)** **Slopes 2:1 (H:V) or steeper**	**1** **2** **3**

Scoring:

Question	Score
#4	
#5	
#6	
#7	
Total:	
Impact Category:	

Score of 4-5 = low impact

Score of 6-9 = medium impact

Score of 10-13 = high impact

Appendix B
Fact Sheets for Permanent Best Management Practices (BMPs)

Permanent BMPs may be classified into two general categories:

- Soil Stabilization (SS) BMPs, and
- Treatment Control (TC) BMPs.

SS BMPs involve the various procedures and considerations that aim to control the sources of pollution. In general, these BMPs treat soils and vegetation as a valuable resource and aim to conserve them. These permanent BMPs should be considered and developed early in the project planning and design process. For example, developing project alternatives that minimize increases in surface runoff and subsequent erosion, or planning a project such that minimal vegetation must be removed.

TC BMPs focus on the removal of pollutants from storm water and reducing pollutant loads to receiving waters. These BMPs treat soils as a pollutant and aim to remove them from runoff. Captured sediments must then often be disposed of properly. These BMPs must also be planned and designed as an integral component of the project. For example, detention or infiltration basin design must consider the amount of paving or other impervious area that may be associated with the project.

TC BMPs are generally less effective and more expensive than SS BMPs. For this reason, SS BMPs should be considered first and TC BMPs should be considered as a second line of defense. TC BMPs should always be used in combination with SS BMPs, however; it may be acceptable to implement SS BMPs on their own in some cases.

B.1 Soil Stabilization Best Management Practices

Project planners and designers must consider and, as appropriate, incorporate certain SS BMPs into a project to minimize impacts to water and air quality. These BMPs were developed in response to the three following design objectives:

- **Prevent Downstream Erosion:** Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion;
- **Stabilize Disturbed Soil Areas:** Disturbed soil areas will be appropriately stabilized to prevent erosion after construction; and
- **Maximize Vegetated Surfaces:** Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

The SS BMPs listed in Table B-1 and described in the following sections are designed to accomplish these objectives.

Table B-1
Soil Stabilization BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
■ Ditches, Berms, Dikes and Swales
■ Slope Down Drains
■ Flared Culvert End Sections
■ Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
■ Vegetated Surfaces
■ Mulches
■ Roughening, Terracing and Rounding
■ Hard Surfaces
Retaining Walls
■ Standard Cantilever Walls
■ Modular Gravity Walls
■ Mechanically Stabilized Earth (MSE) Walls
■ Soil Nail Walls
■ Cantilever Soldier Pile Walls
■ Ground Anchored Walls

B.2 Treatment Control Best Management Practices

Treatment control BMPs, also referred to as structural controls have the objective of protecting receiving waters by:

- Reducing the concentrations of pollutants of concern in storm water runoff through physical, biological, or chemical processes; and/or
- Reducing pollutant loads transported by surface water runoff by infiltrating storm water into the soil and evapotranspiration.

The treatment control (TC) BMPs listed in Table B-2 of this document will be considered for projects discharging directly or indirectly to receiving waters. Treatment controls should be considered for projects where requirements from permits, environmental studies, or total maximum daily load (TMDL) waste load allocations necessitate consideration of these BMPs for projects in specific receiving waters.

Treatment controls are generally more expensive and less effective in protecting water quality than the Soil Stabilization (SS) BMPs. They should therefore be considered as a second line of defense and should not to be used as a substitute for appropriate SS BMPs. Treatment controls are intended to be used in conjunction with SS BMPs to further reduce the impact of storm water on receiving waters when deemed necessary.

Table B-2
Treatment Control Best Management Practices

Biofiltration Swales and Strips
Infiltration Basins
Detention Basins
Traction Sand Traps
Gross Solids Removal Devices

B.3 Runoff Coefficients

The following information may be used to assist the designer with developing permanent BMPS:

- An estimate of the construction site area in acres (see Section 3.1);
- An estimate of the runoff coefficient of the construction site before and after construction (the form shown in Table B-3 may be used to develop the necessary information for runoff coefficients; Tables B-4 and B-5 provide supporting information for the calculation of runoff coefficients); and an estimate of the percentage of the area of the construction site that is impervious (e.g., pavement, building, etc.) before and after construction.

Table B-3
Computation Sheet for Determining Runoff Coefficients

Total Site Area	= _____(A)
Existing Site Conditions	
Impervious Site Area[1]	= _____(B)
Impervious Area Runoff Coefficient[2,4]	= _____0.95_____ (C)
Pervious Site Area[3]	= _____(D)
Pervious Site Area Runoff Coefficient[4]	= _____(E)
Existing Runoff Coefficient = $\frac{(BxC) + (DxE)}{A}$	= _____(F)
Proposed Site Conditions (After Construction)	
Impervious Site Area[1]	= _____(G)
Impervious Site Runoff Coefficient[2,4]	= _____(H)
Pervious Site Area[3]	= _____(I)
Pervious Site Runoff Coefficient[4]	= _____(J)
Proposed Runoff Coefficient = $\frac{(GxH) + (IxJ)}{A}$	= _____(K)

(1) Includes paved areas, areas covered by buildings, and other impervious surfaces.

(2) Use 0.95 unless lower or higher runoff coefficients can be verified.

(3) Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.

(4) See Table B-4 and B-5 for runoff coefficients

Table B-4
Runoff Coefficients for Undeveloped Areas Watershed Types

	Extreme	High	Normal	Low
Relief	0.28 - 0.35 Steep, rugged terrain with average slopes above 30%	0.20 - 0.28 Hilly, with average slopes of 10 to 30%	0.14 - 0.20 Rolling, with average slopes of 5 to 10%	0.08 - 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	0.08 – 0.12 Slow to take up water, clay or shallow soils of low infiltration capacity, imperfectly or poorly drained	0.06 – 0.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	0.04 – 0.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	0.12 – 0.16 No effective plant cover, bare or very sparse cover	0.08 – 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface storage	0.10 – 0.12 Negligible surface depression few and shallow; drainage-ways steep and small, no marshes	0.08 – 0.10 Low; well defined system of small drainage ways; no ponds or marshes	0.06 – 0.08 Normal; considerable surface depression storage; lakes and pond marshes	0.04 – 0.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Given: An undeveloped watershed consisting of:

1) Rolling terrain with average slopes of 5%,

2) Clay type soils,

3) Good grassland area, and

4) Normal surface depressions

Find: The runoff Coefficient, C, for the above watershed

Solution:

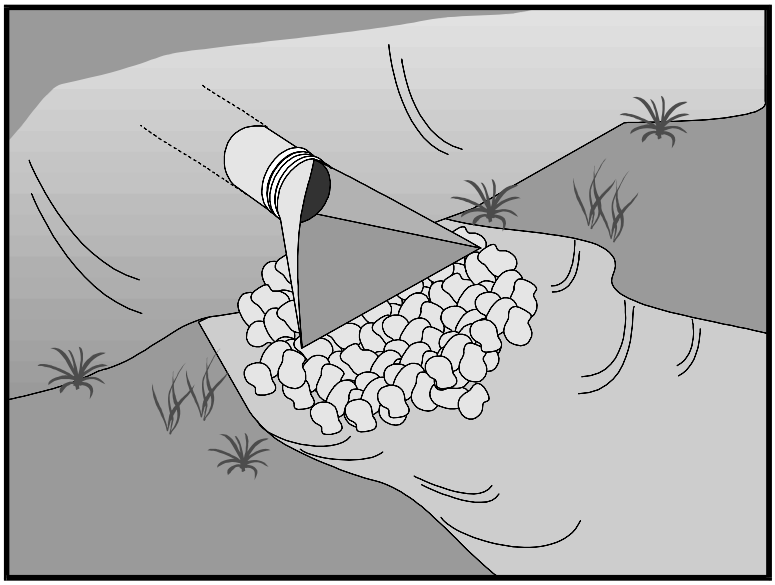
Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
	C=0.32

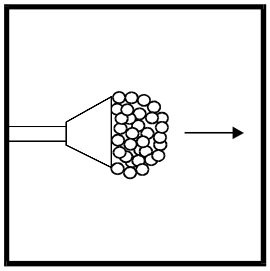
Table B-5
Runoff Coefficients for Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 – 0.95
Neighborhood areas	0.50 – 0.70
Residential:	
Single-family areas	0.30 – 0.50
Multi-units, detached	0.40 – 0.60
Multi-units attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Industrial:	
Light areas	0.50 – 0.80
Heavy areas	0.60 – 0.90
Parks, cemeteries:	0.10 – 0.25
Playgrounds:	0.20 – 0.40
Railroad yard areas:	0.20 – 0.40
Unimproved areas:	0.10 – 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 – 0.10
Sandy soil, average, 2-7%	0.10 – 0.15
Sandy soil, steep, 7%	0.15 – 0.20
Heavy soil, flat, 2%	0.13 – 0.17
Heavy soil, average, 2-7%	0.18 – 0.25
Heavy soil, steep, 7%	0.25 – 0.35
Streets:	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Drives and Walks	0.75 – 0.85
Roofs:	0.75 – 0.95

Outlet Protection/Velocity Dissipation Devices

SS-6





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water

Definition and Purpose

Outlet protection is most commonly composed of a rock apron or concrete headwall and is typically used in conjunction with flared culvert end sections to prevent scour and erosion of the embankment, and reduce the outlet velocity and/or energy of exiting stormwater flows. A variety of velocity/energy dissipators exist, including:

- Grouted or non-grouted rip-rap,
- 90-degree bends or tees at pipe outlets,
- Baffle boxes, and
- Stilling basins.

Appropriate Applications

These devices are typically used at:

- The outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated due to high energy flows exiting these structures.
- Outlets subject to short, intense flows of water, such as from flash floods.
- Where pipes, channels or ditches transition to unlined conveyances.

Outlet Protection/Velocity Dissipation Devices

Limitations/ Precautions

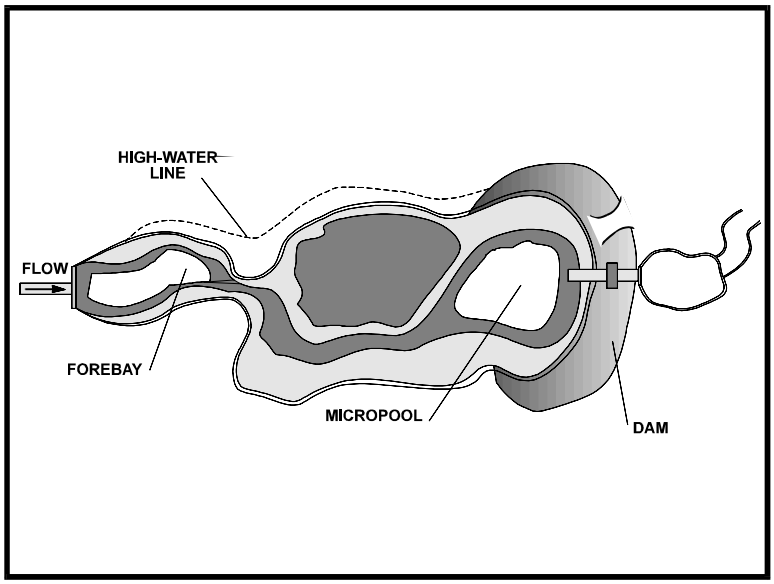
- High flows may cause riprap to wash away.
- Freeze/Thaw cycles may cause grouted riprap to break up.
- If there is not adequate drainage and water builds up behind grouted riprap, it may cause the grout to break up due to the resulting hydrostatic pressure.
- May require maintenance due to sediment/debris accumulation.
- May require additional right-of-way

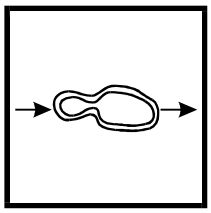
Design Guidance

- There are many types of energy dissipaters; rock, which is represented in Figure SS 6-1, is one common type. However, note that this is only one example and the Hydraulics Engineer must be contacted for region-specific requirements.
- Common device for outlet protection is a structurally lined apron, lined with riprap, grouted riprap or concrete apron. Also see the Flared Culvert End Section BMP fact sheet in this appendix.
- Apron length is related to outlet flow rate and tailwater level.
- A generalized rock apron device is shown in Figure SS 6-1. For additional details and dimensions see NDOT Standard Plan R-3.1.4. Concrete headwalls shall be designed in accordance with the NDOT Standard Plans R-2.4.1 through R-2.7.2.

Detention Basins

TC-3





BMP Objectives

- ● Sediment
- ○ Oil and Grease
- ○ Metals and Toxics
- ○ Nutrients
- ○ Bacteria

- ● Highly Effective
- ○ Low Effectiveness

Definition and Purpose

A detention basin is a permanent device formed by excavating and/or constructing an embankment so that runoff from the water quality design storm is temporarily detained under quiescent conditions, allowing sediment and particulates to settle out before the runoff is discharged.

Appropriate Applications

Consider detention basins for use when runoff from the completed facility will discharge to significant areas of highly valuable habitat in which Federal or State listed aquatic resources have been identified, and NDOT runoff will constitute a substantial portion of the total flows to such habitat. More specifically, detention basins may be appropriate in the following situations:

- Detention basins are used upstream of receiving waters to remove sediment or other pollutants from storm water runoff from highways, roads, parking lots and rest areas, and maintenance areas.
- Detention basins can be used where less permeable soils and/or restrictive subsurface conditions prevent the use of infiltration basins for pollutant removal.
- Detention basins can be designed and constructed in conjunction with flood control basins to reduce peak storm water flow rates for drainage areas where the hydraulic capacity of receiving waters is limited (e.g., 2, 5, 10, 100-yr storms).
- Usual highway placement locations are cloverleaves and dedicated areas in the Right-of-Way.

Limitations

- The quality of the runoff and the intent of the basin should be considered. If the basin is being considered for highly soluble pollutant removal such as nutrients, then an infiltration basin is preferred.
- Detention basins require a large surface area (0.5 to 3% of the contributing drainage area) to permit settling of sediment. Space may be limited for a particular site.
- Detention basins are not typically practical for small drainage areas because the necessary outflow control requires small outlets that clog rapidly.
- If upstream erosion is not properly controlled, detention basins can be maintenance intensive with respect to sediment removal, nuisance odors, and insects (i.e., mosquitoes), etc.
- Detention basins require a differential elevation between inlets and outlets and thus, may be limited by terrain.

Design Guidance

- Access: A permanent area should be provided around the perimeter of the impoundment to allow maintenance. Provisions should also be made for emptying the basin as necessary for maintenance procedures.
- Volume: A general maximum design goal for sizing detention basins is to capture the entire runoff from a treatment design storm event, as discussed in Section 2. The runoff produced by this storm based upon the characteristics of the project drainage area after completion of the project should then be calculated and the resulting volume used as a maximum design target. In cases where traction sand is to be removed and stored in these basins (i.e. no sand traps exist), the volume also should include provisions for sand storage. See TC – 4, Sand Traps for guidance on calculating sand storage requirements.

The basic data requirements for a design analysis are:

- The inflow peak discharge and hydrograph,
- The (allowable) outflow peak discharge,
- The basin stage-storage relationship, and
- The outlet stage-discharge relationship.

The design process consists of establishing the inflow/storage/outflow relationship and adjusting the storage volume and outflow characteristics until the design objectives are met. In most cases, the inflow is fixed by upstream conditions, and the outflow is fixed by the design goals. The purpose of the analysis then is to determine the appropriate basin type, storage volume and outlet configuration. In many cases for roadway drainage design, the storage volume and basin type may be fixed, and the analysis determines the size of the outlet. Figure TC 3-1 is a graphical representation of the storage volume required for on-line detention, off-line detention, and infiltration basins.

The inflow peak discharge and hydrograph are obtained through hydrologic analysis of the upstream watershed. Hydrologic analysis is discussed in detail the FHWA publication "Practical Highway Hydrology", Highway Drainage Series #2, and Hydraulic Engineering Circular #22 (HEC22). The peak discharge is obtained by developing a rainfall-runoff relationship and applying a design storm to determine a peak flow rate. The Rational Method is one very common and well-documented method of determining peak discharge rates. Peak discharges also can be obtained by statistical analysis of past flows, unit hydrograph analysis, regional relationships or other methods. Hydrographs can be obtained from unit hydrograph analysis, synthetic hydrograph methods or the use of physically based computer models such as the United States Soil Conservation Service TR-20 program, subsystem HYDRA in HYDRAIN, or the U.S. Army Corps of Engineers HEC-1 program.

The outflow peak discharge usually is determined by the design objectives. It may be desired to maintain outflow discharge at existing levels, at the capacity of an existing or proposed downstream structure, or at another discharge determined by local conditions. There may be a range of acceptable outflow discharges depending on the magnitude of the inflow discharge.

The basin stage-storage relationship is determined from the topography of the storage basin. The relationship is represented by a table of ponding depth versus total ponding volume. For design of storage basins, determination of basin topography may be a trial-and-error procedure. A preliminary estimate of the total volume required can be made using the procedure described below.

The outlet stage-discharge relationship is determined from the hydraulic characteristics of the outlet. The relationship is represented by a table of ponding depth in feet versus total outflow discharge in cubic feet per second. Determination of the outlet configuration may be a trial-and-error

process. If the outfall type and dimensions are known, it can be a simple matter of a direct hydraulic analysis to determine an outlet stage-discharge relationship (performance curve).

Storage Indication Method (On-Line Basins):

The Storage Indication Method is used for routing of flow through on-line detention basins. This method is based upon the equation:

$$I - O = \frac{\Delta S}{\Delta t} \qquad \text{(Eq. 1)}$$

where:

I = inflow rate, in ft^3/s,

O = outflow rate, in ft^3/s,

S = the change in the storage volume, in ft^3,

Δt = elapsed time, in seconds.

Equation 1 states that inflow minus outflow is equal to the change in storage. The equation can be rearranged for a finite time period as:

$$\frac{(I_1 + I_2)}{2} + \left(\frac{S_1}{\Delta t} - \frac{O_1}{2}\right) = \left(\frac{S_2}{\Delta t} + \frac{O_2}{2}\right) \qquad \text{(Eq. 2)}$$

where:

I_1 = inflow rate at the start of the time period, in ft^3/s,

I_2 = inflow rate at the end of the time period, in ft^3/s,

O_1 = outflow rate at the start of the time period, in ft^3/s,

O_2 = outflow rate at the end of the time period, in ft^3/s,

S_1 = storage volume at the start of the time period, in ft^3,

S_2 = storage volume at the end of the time period, in ft^3,

Δt = duration of the time period, in seconds.

This equation, in conjunction with an inflow hydrograph and the relationship between storage and outflow, can be used to route flows through a detention basin.

Gross Solids Removal Devices (GSRDs)

TC-5

Definition and Purpose

Gross Solids Removal Devices (GSRDs) are intended for use in highly urban settings and are to be used to remove litter and solids from storm water runoff. Gross Solids Removal Devices include physical/mechanical methods of removing litter and solids 0.25 inch nominal and larger from storm water runoff using various screening technologies.

Appropriate Applications

GSRDs should be considered for areas where receiving water bodies are on the 303(d) impaired water body list for trash, or where trash, litter, or other debris has been identified as a major receiving water concern.

GSRDs are still being investigated for functioning under different loading and flow patterns in order to refine design and determine effectiveness. Some health and safety aspects are being evaluated too. Effective operation of device is dependent on appropriate maintenance. Two types of GSRDs that have been installed and function effectively include:

1. Linear Radial GSRD, and
2. Inclined Screen GSRD.

- The Linear Radial Device (Figure TC 5-1) utilizes modular well casings with 0.25-inch nominal louvers to remove litter. The louvered well casings are contained in a concrete vault. Flows pass radially through the louvers trapping litter and solids in the casing and passing flows into the vault for discharge via an outlet pipe. The bottom of the casing is smooth to allow trapped litter to move to the downstream end of the well casing. The device requires very little head to operate and has

been pilot tested for 1% slope. Flatter slopes may work but have not been tested. The Linear Radial Device is designed to work in-line with the existing storm drain system or could be placed in an off-line configuration. In-line configuration incorporates overflow/bypass if the unit becomes plugged. As shown in Figure TC 5-1, the first foot and a half of the linear well casing is non-louvered with an open top to allow for influent bypass should the device become clogged with litter. The circular louvered sections have access doors that can be easily opened to facilitate cleaning with a vacuum truck or other equipment if necessary. The device is covered with a load-bearing grating appropriate to the location.

- In the Inclined Screen Device, the flow overtops a weir and falls through an inclined bar rack (wedge-wire screen) with a 0.125-inch nominal maximum spacing between the bars, located after the influent trough. After passing through the rack, the flow exits the device via the discharge pipe. A distribution trough is provided to allow influent to be distributed along the length of the Inclined Screen. The litter captured by the bar rack is pushed down toward the litter storage area by the storm water runoff. Parabolic wedge-wire screen inclined at 60 degrees and 3 ft high was tested in pilot studies and worked effectively. Other configurations with different inclinations and heights of the screen may work but have not been pilot tested. In order to minimize the footprint of the device, a 90-degree elbow configuration of the screen (Figure TC 5-2) was used in the pilot study. Other configurations of the screen can be used on a site-specific basis. The gross solids storage area is sloped and is provided with a drain to prevent standing water. As shown in Figure TC 5-3, an opening above the litter storage area is provided to allow for overflow/bypass if the device becomes plugged. The device should be designed for litter and debris storage for a period of one year. The device is covered with a load-bearing grating appropriate to the location.

The Linear Radial Device requires very little head to operate and is well suited for narrow and relatively flat rights-of-way with limited space. The Inclined Screen requires about 5 ft. of head and is well suited for fill sections of the highways.

Design Guidance

The two most important factors affecting the design of these devices are: (1) the need to be sized to accommodate both gross pollutants storage for a given maintenance period (typically one year), and (2) the hydraulic capacity of the drainage system in which it is to be installed. Litter and debris accumulation data need to be available to properly size the devices for the given drainage area. If regional debris accumulation data are not

available, then 10 ft^3/ac/yr may be used. These devices can be designed both in-line and off-line. In-line configuration incorporates overflow/bypass if the unit becomes plugged. A summary of preliminary design factors is presented in Table TC 5-1.

Maintenance and Inspection

GSRDs require sufficient space and/or access ramps for maintenance and inspection including the use of vactor trucks or other large equipment to remove accumulated trash.

Table TC 5-1
Summary of Gross Solids Removal Devices
(Linear Radial and Inclined Screen)

Description	Applications/Siting	Planning and Design Considerations
Treatment Mechanisms: ▪ Filtration through screens Pollutants removed: ▪ Litter and solid particles greater than 0.25 in. nominal	▪ Site conditions must have adequate space for device and maintenance activities. ▪ Sites that drain to litter sensitive receiving waters on 303(d) list for trash or areas where TMDLs require trash removal. ▪ The Linear Radial Device requires little head to operate and is well suited for flat sections of highway. ▪ The Inclined Screen requires 5 ft. of head and it is well suited for fill sections.	▪ Regional litter accumulation data is desirable; otherwise use 10 ft^3/acre/year. ▪ Devices must be sized for peak design flow while carrying design gross solids load. ▪ The Linear Radial Device well casing is available up to 36 in. diameter. ▪ Devices can be placed in-line incorporating bypass/overflow or it may be placed offline.

Gross Solids Removal Devices (GSRDs)

Figure TC 5-1
Example Schematic of Linear Radial Device (Not a Standard Plan)